

GPlates Exercises

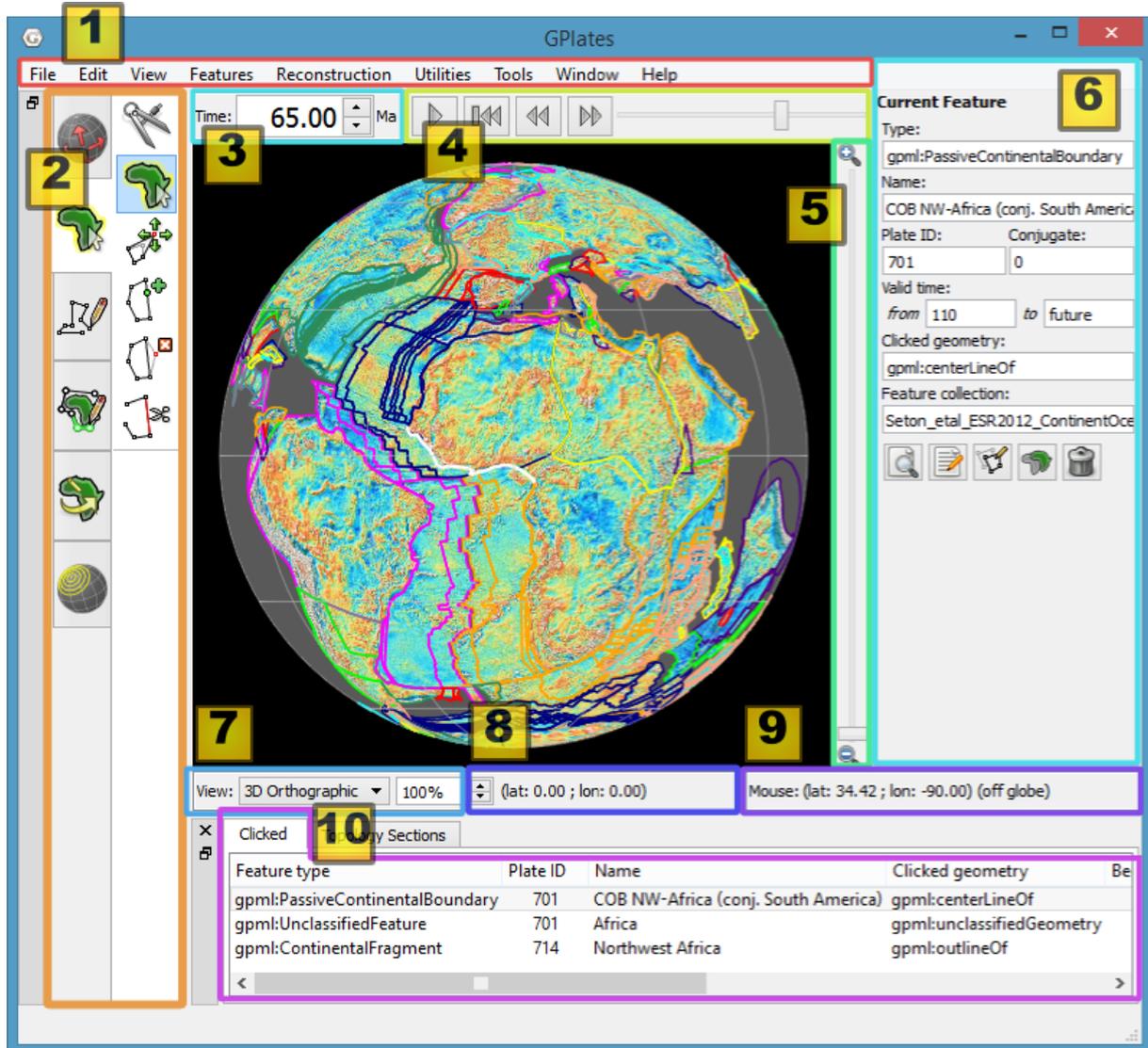
From GPlates user manual and tutorials

1. Downloading and Installing GPlates

- (1) Go to the website: <https://www.gplates.org/download>.
- (2) Download GPlates 2.0 for your MacOS X([GPlates-2.0.0-Darwin-x86_64.dmg](#)) or Windows system ([gplates-2.0.0-win32.msi](#)).
- (3) For **Windows**, Running the installer program will install GPlates to your system.
- (4) If you **DO NOT install** it on your **windows** system, download the zip file [gplates-2.0.0-win32.zip](#), containing the GPlates executable and its dependency files.
- (5) For **MacOS X**, double-click on a .dmg file, then drag the GPlates binary into your Applications folders.

2. The Main Window

When you start GPIates, the **Main Windows** looks like below:



Item	Name	Description
1	Menu Bar	This region of the Main Window contains the titles of the menus.
2	Tool Palette	A collection of tools which are used to interact with the globe and geological features via the mouse pointer.
3	Time Controls	A collection of user-interface controls for precise control of the reconstruction time.
4	Animation Controls	A collection of tools to manipulate the animation of reconstructions.
5	Zoom Slider	A mouse-controlled slider which controls the zoom level of the Globe View camera.
6	Task Panel	Task-specific information and controls which correspond to the currently-activated tool.
7	View Control	Controls which projection is used to display data and the exact zoom level as a percentage.
8	Camera Coordinate	An information field which indicates the current globe position of the Globe View camera.
9	Mouse Coordinate	An information field which indicates the current globe position of the mouse pointer.
10	Clicked Geometry Table	Displays a summary of each geometry or feature touched by the last mouse click.

3. Plate reconstructions

Feature Collections

All data loaded into GPlates are referred to as Feature Collections. This is because all data in GPlates are regarded as 'features' (e.g. MORs, volcanoes, etc). For example, under the folder /SampleData, you can see FeatureCollection contains the outlines of all the present-day coastlines of the world, these coastlines can be thought of as features and therefore when we load the coastline file we are loading a 'feature collection'.

Loading Data

- (1) File → Import → Import Rasters... → Choose: /The-Path-Where-You-Installed-GPlates/SampleData/Rasters/**color_etopo1_ice_low.gpml** → Open
- (2) Figure out the areas of famous mountains: Alps, Himalaya (Asia), Rocky Mountains (North America), Altiplano-Puna (South America).

Task 1: Find the **area of Potsdam** through controlling the view (Zoom in/out, Camera Control, View of Projection style etc.)

Creating a New Feature

- (1) Tool Palette → Digitisation 3  → Digitise new Polygon Geometry → Click on the globe → Pick several points to consist the area of Polygons → Create Feature → Next → Plate ID (the plate which you want to attach your new feature to) → Begin/End time of appearance (the same values as that in the plate) → Next → Next → Creat.
- (2) Now you can see the new feature **Layer** * (e.g., Layer 1) in the Layers window. If you do not see the Layers window, go to the Menu bar, Window → show Layers
- (3) File → Open Feature Collection (Shortcut key Ctrl+O) → Choose: /The-Path-Where-You-Installed-GPlates/SampleData/FeatureCollection/StaticPolygons/**Muller_etal_AREPS_2016_StaticPolygons.gpmlz** → Open

Task 2: Digitise a **new polygon geometry** feature to represent the Potsdam area and attach the new feature to the plate "England-Brabant (Avalonia)" with the same Plate ID

Saving the new layer

Layers provide a way to connect the various processing capabilities of GPlates to data sources (such as loaded feature collections). The outputs of these layers can

then be visualised directly in the globe and map views and/or passed to the input of other layers for further processing.

- (1) Create your own personal folder under the directory /SampleData.
- (2) File → Manage Feature Collection (Shortcut key Ctrl+M) → Choose New Feature Collection → “Save as...” in Actions → Rename it to your personal folder (for example, PotsdamArea) → Save

Go to the Layers Window, now you can see your new feature with renamed layer (PotsdamArea). The layer can be showed or hided by clicking the eye .

- (3) Hide the layer of **Muller_et al_AREPS_2016_StaticPolygons**.
- (4) Go the layer **color_etopo1_ice_low.gpml** and open this layer menu. Inputs → Reconstructed polygons: → Add new connection – Choose Muller_et al_AREPS_2016_StaticPolygons.

Task 3: Investigate the evolution of Atlantic formation and find when it does start to form the Atlantic between South America and Africa.

Plate reconstructions

The raster is rendered as a non-rotating georeferenced raster (in this example a global raster of world topography map **color_etopo1_ice_low.gpml**). Changing the reconstruction time makes no plate rotations. Therefore, the rotation feature should be added to reconstructing the raster.

Plate-tectonic reconstructions are the calculations of the probable positions, orientations and motions of tectonic plates through time, based upon the relative (plate-to-plate) positions of plates at various times in the past which may be inferred from other data. Geological, geophysical and paleo-geographic data may be attached to the simulated plates, enabling a researcher to trace the motions and interactions of these data through time. Geological time instants in GPlates are measured in units of Mega-annum (Ma), in which 1 Ma is equal to one million years in the past.

- (1) File → Open Feature Collection → Choose: /The-Path-Where-You-Installed-GPlates/SampleData/FeatureCollection/Rotations/**Matthews_et al_GPC_2016_410-0Ma_GK07.rot** → Open
- (2) Reconstruction → Configure Animation... → Animate from: 400 Ma to 0 Ma with an increment of: * Ma.

Task 4: Find out the Position (i.e., Latitude and Longitude) of Potsdam area (the new polygon feature in task 2) at 0 Ma, 50 Ma, 100 Ma, 200 Ma, 300 Ma.

Velocity field

Gplates is capable of directly generating time-dependant velocity fields, which can be used as plate kinematic input for geodynamic modelling codes.

- (1) Go to Layers Window (Ctrl+L) → Add new layer → Calculated Velocity Fields → OK
- (2) Open this velocity layers' menu and choose Inputs → Velocity domains → Add new connection - Muller_etal_AREPS_2016_StaticPolygons.
- (3) Velocity & Interpolation options → Calculate velocities – of domain points

The plate (for example, North America Plate) can be fixed as an absolute reference plates to trace the motion of other plates relative to North America Plate.

- (4) Reconstruction → Specify Anchored Plate ID – 101 (North America plate) → OK.
- (5) Visualize the relative plate configuration at 200 Ma - 0 Ma.

Exporting images of plate reconstruction

GPlates allows you to export reconstructed geometries and images of plate reconstruction, either for a single snapshot or a sequence of snapshots. Also, the calculated velocity field can be exported to be used in geodynamic modelling codes. This functionality allows you to extract palaeo-coordinates for feature data that you have reconstructed back through time using a rotation model.

- (1) Reconstruction → Export... → Export Time Sequence of Snapshots → Time Range- Choose your own range of animation → Add Export → Image (screenshot) → Choose Output File Format – any format you like (for example, *.jpg) → Specify Output Filenames – rename the Template → OK
- (2) Back to Export → Target directory: /SampleData/Your-own-folder/Create-A New-folder-for-snapshots of Plate Reconstruction → Begin Export

Further exercises: looking at critical stages of Earthevolution

1. 252 Ma- Siberian Large Igneous Province and largest mass extinction
2. 200Ma-120Ma different stages of Pangea break-up
3. 100-0Ma- India rase and collision in Tibet, Greater Indea