Lesson 1: Exploring the Seafloor using GeoMapApp – Student Version

Lesson Objectives: At the end of the lesson, students will be able to:

- Launch GeoMapApp and Choose a Projection.
- Use the GeoMapApp menu options and toolbar to navigate in a map layout, including zoom in, zoom out, pan and return to full world view.
- Add data layers to the map view.
- Use the GeoMapApp Gazetteer to load and search for geographic place names.

Background: A map ***projection*** is a procedure or mathematical formula used to transform a curved surface onto a plane. The curved surface is usually the surface of the Earth and the plane is what we call a "map." Coordinates for points on the surface of the Earth are given in ***latitude,*** marked 90° north and 90° south from the 0° parallel of the equator, and ***longitude***, which is marked 180° east and 180° west from 0° at Greenwich, England. ***Absolute location*** is determined by the reference grid of these intersecting lines on the Earth, called the Graticular network (Figure 1). Points on a map can be accurately defined by giving degrees, minutes, and seconds for both latitude and longitude, for example, San Diego, California is located at approximately 32.719°N latitude and -117.164° W longitude.

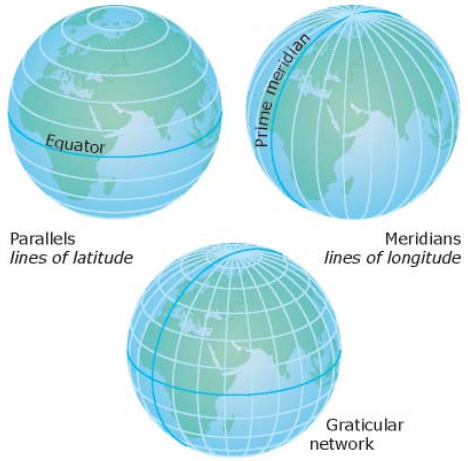


Figure 1. Images of the Earth showing meridians, parallels, and Graticular network.

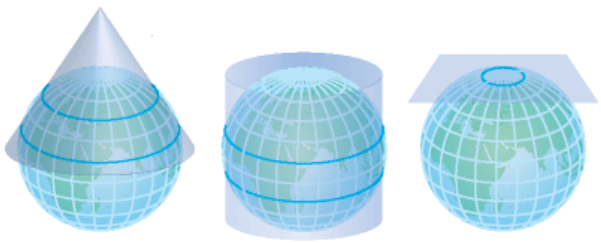


Figure 2. The three classes of map projections.

The ***Mercator projection*** option in GeoMapApp is a cylindrical projection and has straight **meridians** (lines of longitude) and **parallels** (lines of latitude) that intersect at right angles (Figure 2). The scale is accurate at the equator, where the projection cylinder comes in contact with the earth, an area known as the line of tangency. Accuracy in a cylindrical projection diminishes closer to the poles.

The ***South Polar*** and ***North Polar*** projections available with GeoMapApp are ***Stereographic Azimuthal projections*** (Figure 2). The distances measured from the center are true, and distortion of geographic features increases away from the center point.

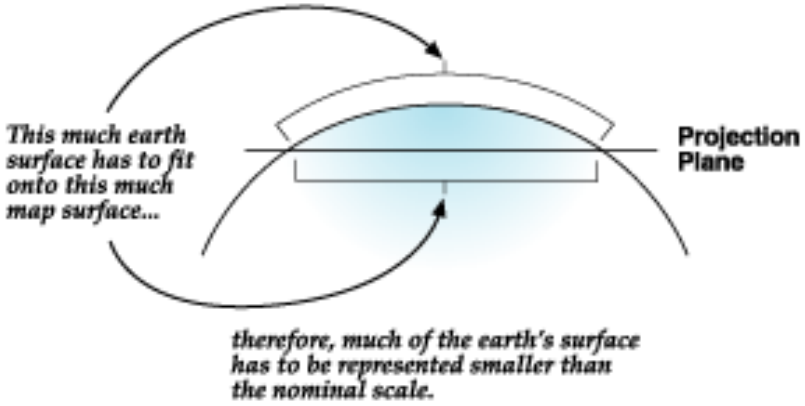


Figure 3. Diagram depicting distortions in projections.

Figure 3 shown above depicts the challenge of displaying a map image (a 2 dimensional object) that represents a 3 dimensional object (the Earth). The earth surface must be projected from its true curved surface onto a flat surface, and distortion of shape, area or distance results.

Getting Started

Before you begin Exercise 1, you will need to download and unzip the GeoMapApp folder and all of the data layers.

1. Create a folder on your C drive. Name your folder using NO SPACES OR SPECIAL CHARACTERS. Spaces can be problematic for computer programs, so use and underscore character instead of a space. Also, keep your file names short and use only alphanumeric characters, for example, C:/GeoMapApp (no spaces), C:/GMA_Module1, C:/GMA_Whales.

2. Download the GeoMapApp.zip folder to the folder you created on your C:/ drive or to a folder set up by your instructor. The GeoMapApp.zip folder contains shapefiles and data files that you will import into your GeoMapApp session in order to explore computer mapping and conduct geospatial analysis.

3. After you download the zipped file into your working folder, unzip the files by:

    a. Open Windows Explorer and browse to the location where you have copied the zip file.

    b. Next, right click on the GeoMapApp.zip folder and select 'Extract all'.

    c. In the wizard, make sure you are extracting your files to your working folder.

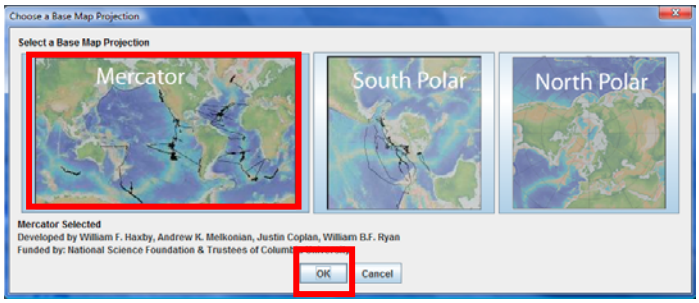
Exercise 1: Exploring the Seafloor Using GeoMapApp

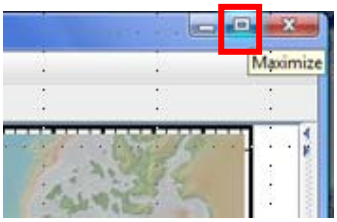
In this exercise, you will learn how to choose a projection, navigate in a GeoMapApp map viee. create and save a profile of a section of the ocean seafloor, explore geographic places and locate oceanic features using the GeoMapApp Gazetteer.

1. Launch GeoMapApp. Double click on the GeoMapApp icon 

on your desktop.

2.Choose a map projection. Select the appropriate projection for the datasets you will use and the area of the world you are most interested in viewing. For this exercise, select the projection option, 'Mercator', by clicking on the first box that shows a map of the world. When the Mercator Box is highlighted and the Window below the box says 'Mercator Selected', Click the 'OK' button.

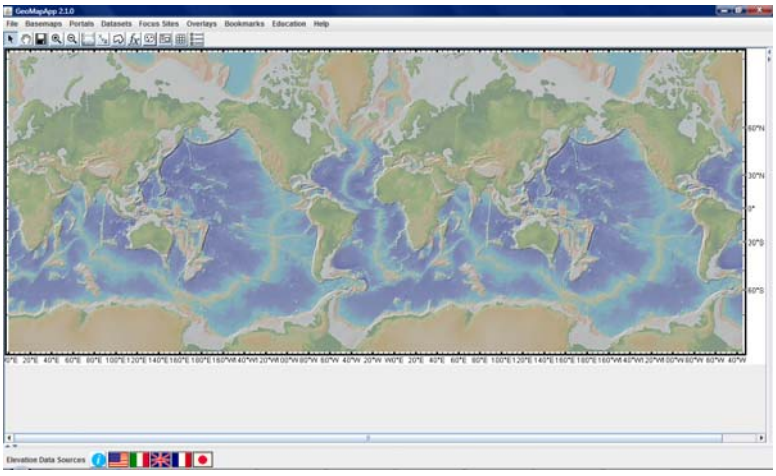




3. Maximize your GeoMapApp session. Click on the maximize button in the upper right hand corner.

4. Examine the GeoMapApp user interface. Notice the map layout, menu choices and toolbar.

Question 1. Describe the map layout.



Question 2. How does this map differ from other maps of the world you have seen?

5. Explore the GeoMapApp toolbar. Roll your mouse cursor over each of the buttons and notice the name of the button that pops up.

Question 3a. Fill in the name of each of these buttons:

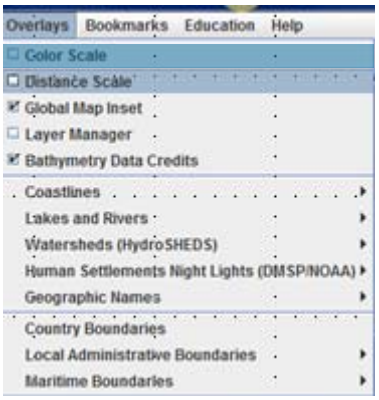
 _____  _____  _____

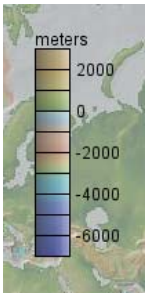
 _____  _____  _____

Question 3b. List the first 5 menu options available under the 'Overlays' choice.

_____

6. Add the Color Scale and Distance Scale. From the menu, select 'Overlays' and click on the box next to 'Color Scale'. Repeat this step and click the box next to 'Distance Scale'.



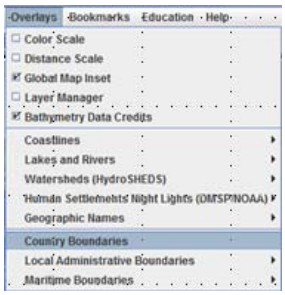


The Color Scale corresponds to the colors on the map, and allows the map user to estimate heights on landforms and depths in the ocean.

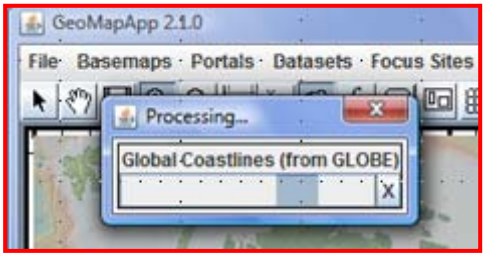
The Distance Scale shows the distance approximation and allows for a quick visual estimate of distance.

7. Add data to your map.

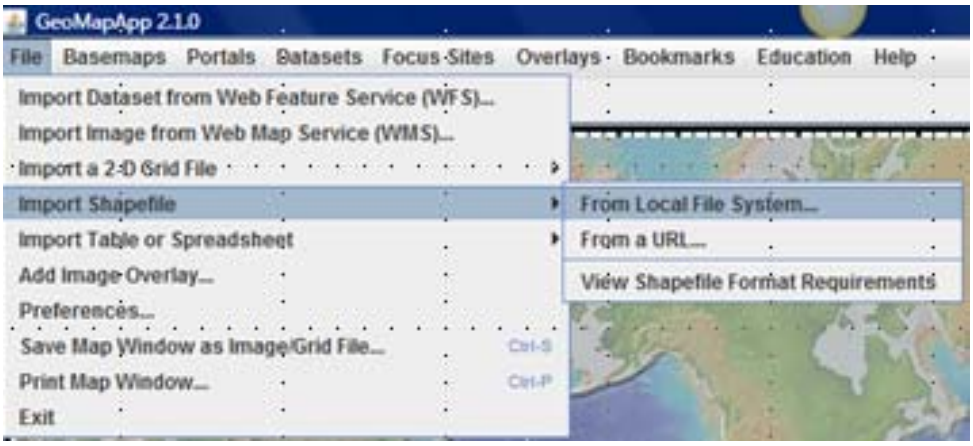
a. **Add a GeoMapApp data set.** From the menu options, select 'Overlays' → 'Country Boundaries'. Repeat this step and add data for Lakes and Rivers ('Overlays' →' Lakes and Rivers' → 'Lakes and Major Rivers'). Repeat this step and add data for political boundaries('Overlays' → 'Local Administrative Boundaries' → 'All Countries').



User Tip: Be patient with the GeoMapApp program, especially when you see the 'Processing' Window pop up. The program is communicating with the server and downloading large data sets.



b. Add data stored in a local folder. From the menu options, select 'File', and then 'Import Shapefile', and choose the 'From Local File System' option. Navigate to folder with your lesson data, e.g. (C:/GeoMapp/Lesson1Explore) and click on the geogrid.shp file, then click 'Open' to add grid lines to your map view.



8. Change the appearance and order of your data layers. A map can become too cluttered when you add multiple layers. Some data layers can cover up or obscure other layers, for example point data should be displayed on top of line data. If you had rivers and cities data sets, you would want to put the cities layer (point file) on top of the rivers layer (line file). You can change the way your data is displayed in several ways.

a. Move the Layer Manager dialog box by clicking on the blue title bar and holding down the mouse button as you move the box to another location.

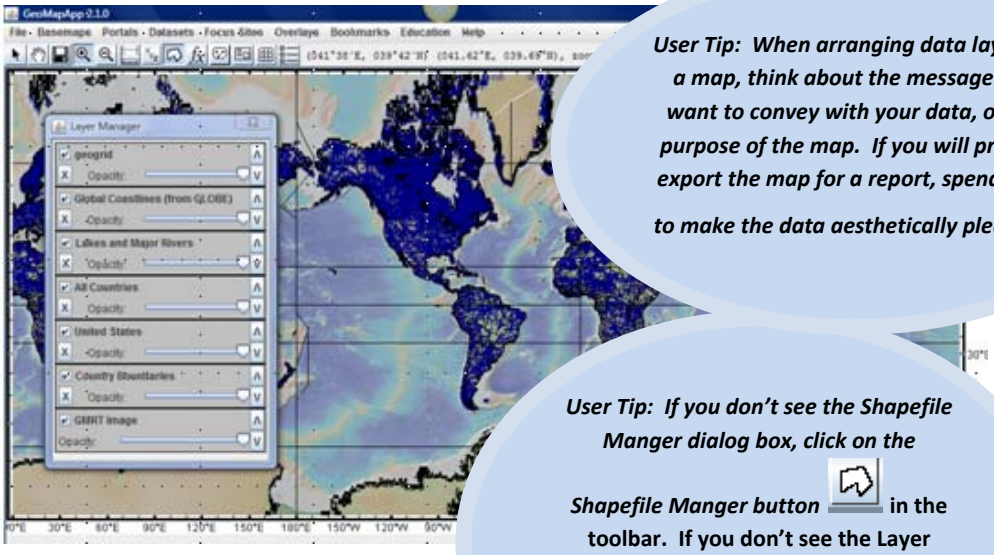
b. Resize the Layer Manager window if desired by rolling the mouse over the corner until a double headed arrow appears, then clicking and dragging to resize.

C. Turn off layers by clicking in the check box next to the name of the layer. Turn layers back on by clicking in the same box.

d. Move the layer position (top-to-bottom order) by clicking on the up or down arrows next to the name of the layer.

e. Change the opacity of the layer by clicking on the sliding tab and moving it to the right or left.

f. Delete layers by clicking on the x in the layer name box.

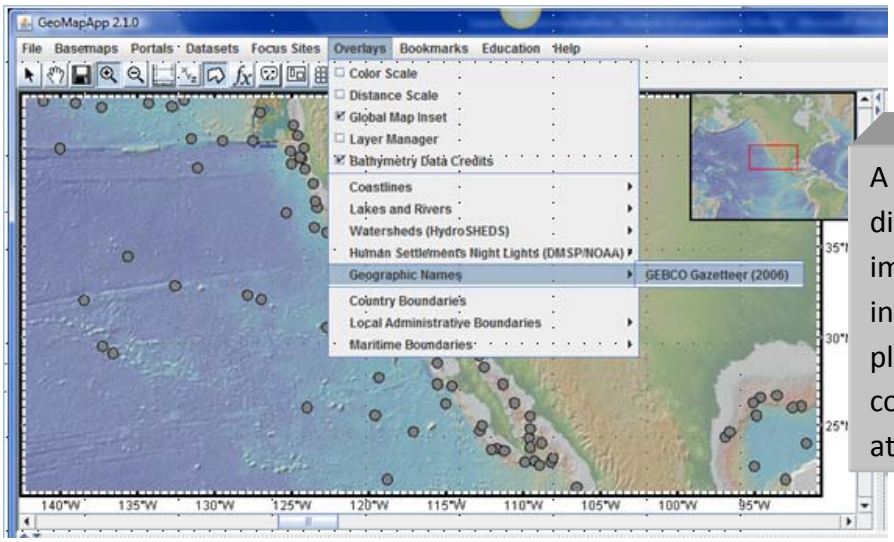


User Tip: When arranging data layers in a map, think about the message you want to convey with your data, or the purpose of the map. If you will print or export the map for a report, spend time to make the data aesthetically pleasing.

User Tip: If you don't see the Shapefile Manger dialog box, click on the Shapefile Manger button **in the toolbar. If you don't see the Layer Manager dialog box, look in your docking toolbar at the bottom of your window. You may need to click on the Layer Manager here to open it.**

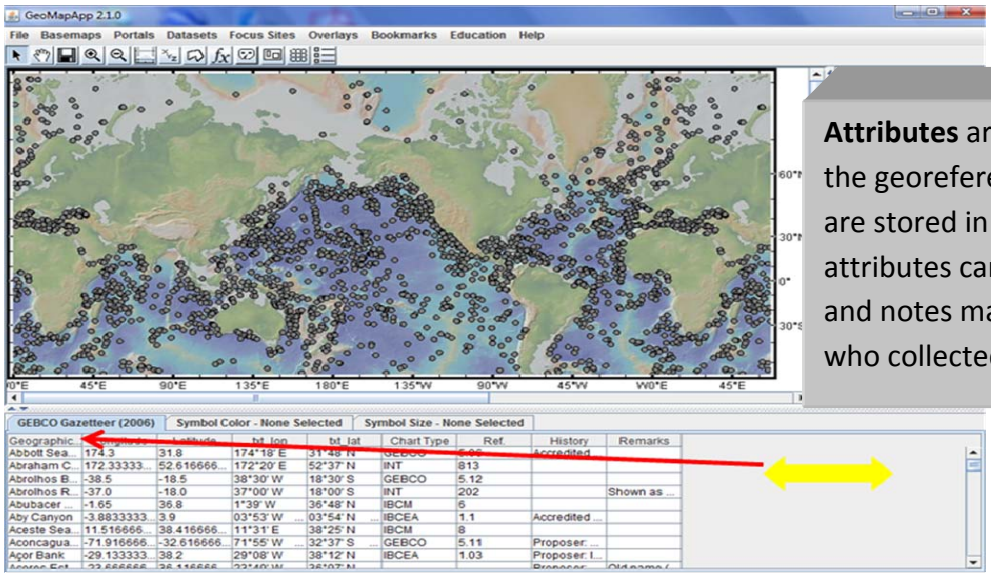
9. Delete all the layers you added in Step 8.

10. Add the Gazetteer Layer. Select 'Overlays' from the Command Menu → Select 'Geographic Names' → Select 'GEBCO Gazetteer (2006)'.



A **gazetteer** is a geographical dictionary or directory, an important reference for information about places and place names used in conjunction with a map or atlas.

11. Change the width of the columns in the data table. The data table opens below the map view window. Move your cursor over the table headings, and find the border between the first two columns. The cursor will become a double-headed arrow. Click and hold down the mouse, and drag the column heading to the right to increase the size of your column.



Attributes are features related to the georeferenced data, and they are stored in columns. Types of attributes can include names, codes and notes made by the scientists who collected the data.

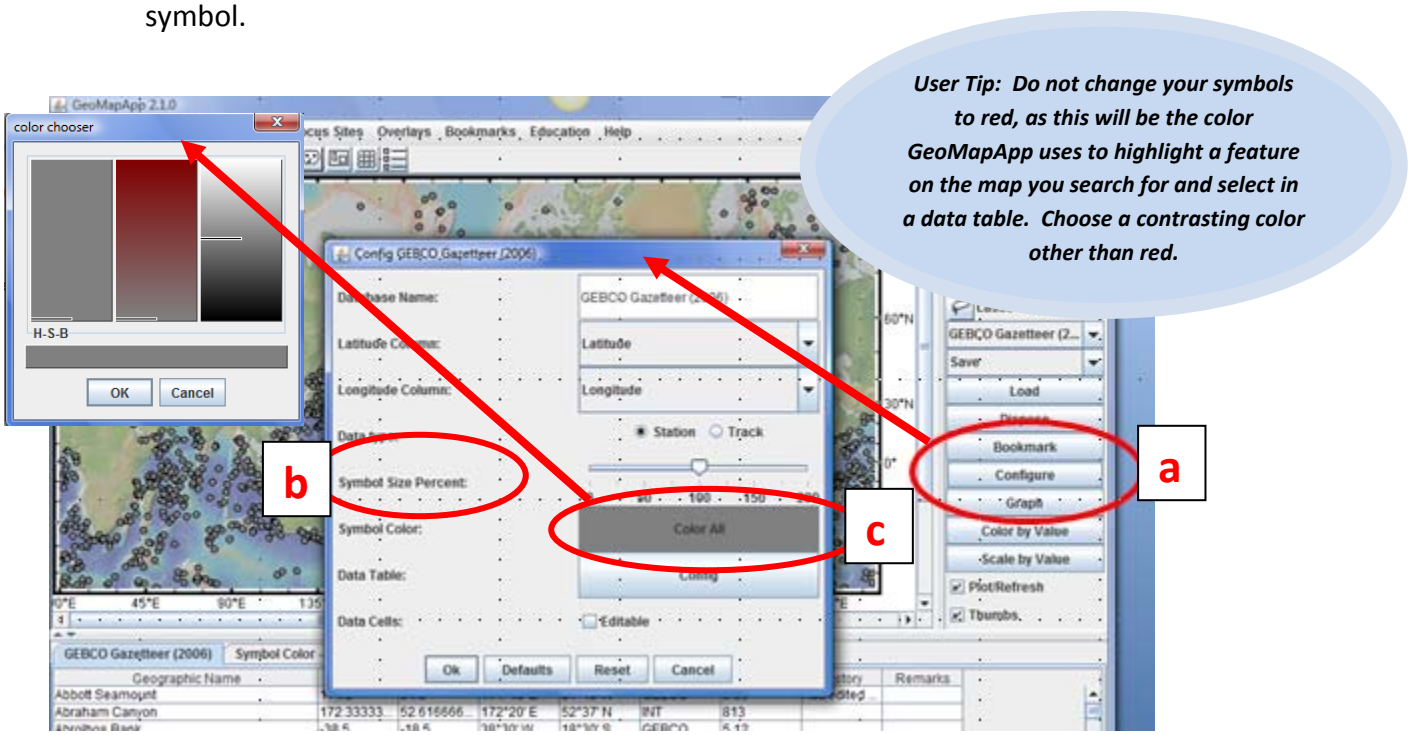
Question 4. What types of attributes are included in the Gazetteer data table? ***Hint: Look at the titles of the column headings.***

12. Change the appearance of the Gazetteer symbols.

a. Click on the 'Configure' button in the column to the right of the map view.

b. In the 'Config GEBCO Gazetteer' dialog window that opens, change the size of the symbols by sliding the 'Symbol Size Percent' tab to 200.

c. Change the color of the symbols by clicking in the 'Color All' box. A 'color chooser' dialog box opens with sliding bars that allow you to change the hue, shade and brightness of the symbol.

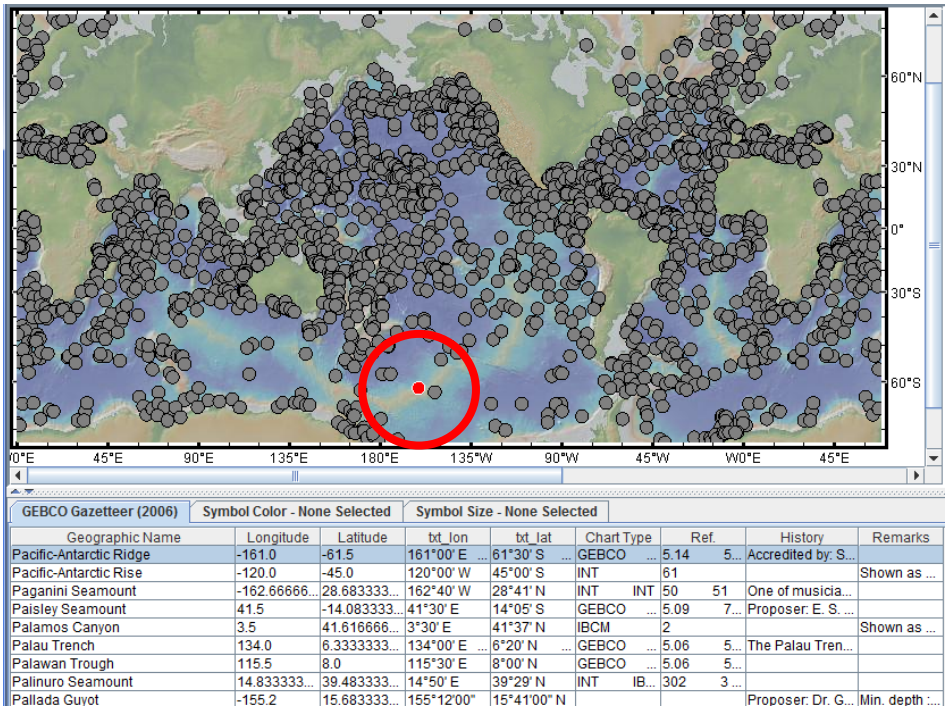


User Tip: Do not change your symbols to red, as this will be the color GeoMapApp uses to highlight a feature on the map you search for and select in a data table. Choose a contrasting color other than red.

13. Search the Gazetteer feature for geographic features located around the world.

a. Double click on the column heading 'Geographic Name' and notice that the list of geographic names switches from A → Z to Z → A order.

b. Scroll through the Gazetteer table until you find the record called Pacific-Antarctic Ridge and click on the record. Notice the map view window. The feature you have highlighted in the table turns the corresponding symbol on the map red.



GEBCO Gazetteer (2006) | Symbol Color - None Selected | Symbol Size - None Selected

Geographic Name	Longitude	Latitude	txt_lon	txt_lat	Chart Type	Ref.	History	Remarks
Pacific-Antarctic Ridge	-161.0	-61.5	161°00' E	61°30' S	GEBCO	5.14 5...	Accredited by: S...	
Pacific-Antarctic Rise	-120.0	-45.0	120°00' W	45°00' S	INT	61		Shown as ...
Paganini Seamount	-162.66666...	28.683333...	162°40' W	28°41' N	INT INT	50 51	One of musicia...	
Paisley Seamount	41.5	-14.083333...	41°30' E	14°05' S	GEBCO	5.09 7...	Proposer: E. S. ...	
Palamos Canyon	3.5	41.616666...	3°30' E	41°37' N	IBCM	2		Shown as ...
Palau Trench	134.0	6.3333333...	134°00' E	6°20' N	GEBCO	5.06 5...	The Palau Tren...	
Palawan Trough	115.5	8.0	115°30' E	8°00' N	GEBCO	5.06 5...		
Palinuro Seamount	14.833333...	39.483333...	14°50' E	39°29' N	INT IB...	302 3 ...		
Pallada Guyot	-155.2	15.683333...	155°12'00"	15°41'00" N			Proposer: Dr. G...	Min. depth :...

Question 5. Where is this feature (Pacific-Antarctic Ridge) located?

14. Zoom in to the Pacific Antarctic Ridge.

a. Change your cursor to a 'Zoom In' tool by clicking on the button that looks like a magnifying glass with a plus sign,  . You can draw a box around the region of interest, or click on the map and the view will zoom in.

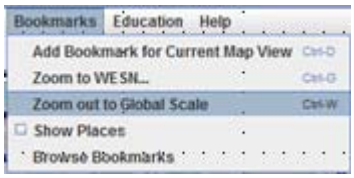
b. Use the Pan Tool  to grab the map view and move it up/down or left/right.

c. Use the Zoom Out Tool  .

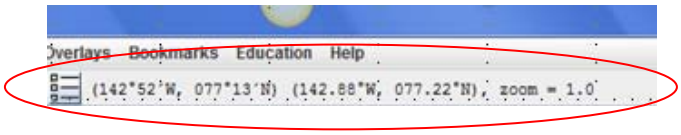
d. Once you have zoomed into a location on the map, change your cursor back to an arrow by clicking on the black arrow button  in the toolbar.

Question 6. Based on what you have observed in your map view and exploration of the Pacific Antarctic Ridge, describe the oceanic feature called a ridge. What terrestrial land form does a ridge on the ocean floor resemble?

15. Zoom back out to World View. Select the 'Bookmarks' menu option → Select 'Zoom out to Global Scale'. You can also use the command feature by simultaneously holding the Control and W keys ('Ctrl + W') on your keyboard.



16. Use the skills you have learned in this lesson to complete the Absolute Location Exercise and fill in the table of Question 7. You can determine latitude/longitude coordinates from the Gazetteer table and from the GeoMapApp window, notice how they represent the location of your cursor.



Absolute location is defined by the coordinate system values, or units of a map. In GeoMapApp, the coordinate system is measured in units of latitude and longitude. **Relative location** of a geographic feature describes the location in reference to other features, e.g., the Hawaiian Islands are located in the Pacific Ocean would be a relative location.

Question 7. Find the following geographic features and complete the table below.

Geographic Feature	E or W	Longitude	N or S	Latitude
Great Barrier Reef				
La Jolla Canyon				
East Pacific Rise				
San Juan Seamount				
Find your own features. Search the Gazetteer data table for features that interest you, or search on the map for locations that you are curious about.				

Lesson Objectives: At the end of the lesson, students will be able to

- Launch GeoMapApp and Choose a Projection.
- Navigate in a GeoMapApp user interface, including zoom in, zoom out, pan and return to full world view.
- Add data layers to the map view.
- Use the GeoMapApp Gazetteer to load and search geographic place names.

Tools/Skills and Key Words Used in Lesson

 Zoom In Tool  Zoom Out Tool  Pan Tool  Shapefile Manager

Skills: Launch GeoMapApp, choose a projection, add data, change appearance of data, add Gazetteer, search Gazetteer for features, and navigate around map view.

Key Words: projection, plane, Mercator projection, Stereographic Azimuthal projection, South Polar projection, North Polar projection, meridians, parallels, latitude, longitude, geographic coordinates, Gazetteer, absolute location, relative location.

Diving In Deeper - Extending the Lesson

1. (Flatten an orange activity) Draw an outline of the continents on an orange, then peel and flatten. Notice the distortion caused by flattening. This distortion is what mathematical formulas attempt to minimize.
http://pulse.pharmacy.arizona.edu/9th_grade/culture_cycles/world_geography/earth_orange.html

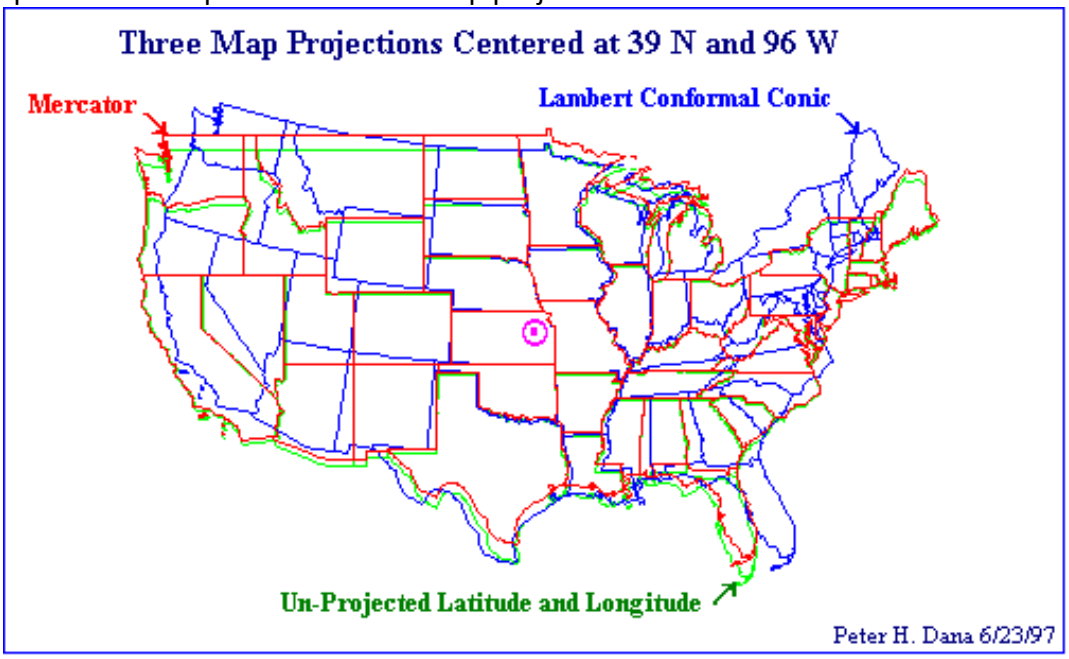
2. Explore the Multimedia Tutorials on the GeoMapApp website to learn more about the common tasks you can perform with GeoMapApp.

View the multimedia movies listed below to learn how to perform common tasks with GeoMapApp. You must have Flash installed on your computer for these tutorials to play correctly. Click on a link below to view.

Tool Bar Functions

Tutorial	Description
Zoom and Pan	How to zoom in/out and pan
Mask Function	Highlights areas of higher-resolution topography
Profile Tool	Generate a profile across any type of grid
Grid Tool: Basics	Change colours, sun illumination, vertical exaggeration, contours
Grid Tool: 3-D View	View topography in three dimensions, rotate, tilt and save image
Digitizer Function	Digitize a custom depth profile
Contributed Grids	View many types of contributed regional grids
Web Feature Services	Use WFS to view stations/samples from various databases

3. Compare different types of map projections. Search for images on the web with different projections that show the difference in the same land form as represented on one map image. The example below compares 3 different map projections of the conterminous United States.



http://www.colorado.edu/geography/gcraft/notes/mapproj/gif/threepro.gif.

References and Web Searches for Teachers and Students

Image Sources: (Fig 1, 2, 3) http://webhelp.esri.com/arcgisdesktop/9.2,

GeoMapApp, Data Exploration and Visualization Tool http://www.geomapapp.org/

GIS and Remote Sensing: About Map Projections http://gisremote.blogspot.com/2008_02_10_archive.html

Points, Pixels and Grids: A Mapping and Gridding Primer http://geospatialmethods.org/documents/ppgc.html