Using "Our Dynamic Planet"
(part of the EarthEd CDROM)

"Our Dynamic Planet" is software that will allow you to view very large quantities of real Earth data as simply as "point and click." If Earth scientists, who developed the theory of plate tectonics, had access to the data on this CD, they would have been ecstatic. This powerful data visualization software will allow you to easily access Earth data and make plots and pictures that will be key components of your Earth Summit tectonics science paper.

Launching "Our Dynamic Planet:"

The "Our Dynamic Planet" module is launched from the "Office" screen of EarthEd. See the "Go to Plate Tectonics" button in Figure 6 of the Lab #1 software tutorial writeup.

The "Our Dynamic Planet" data workshop screen

Figure 11 shows the workshop screen where you can access the various software tools that you will need. Notice that when you move the mouse around over the various parts of the screen, information appears on the screen to the right. This information will help you understand the philosophy of this material, and the exercises you will be doing in this class.

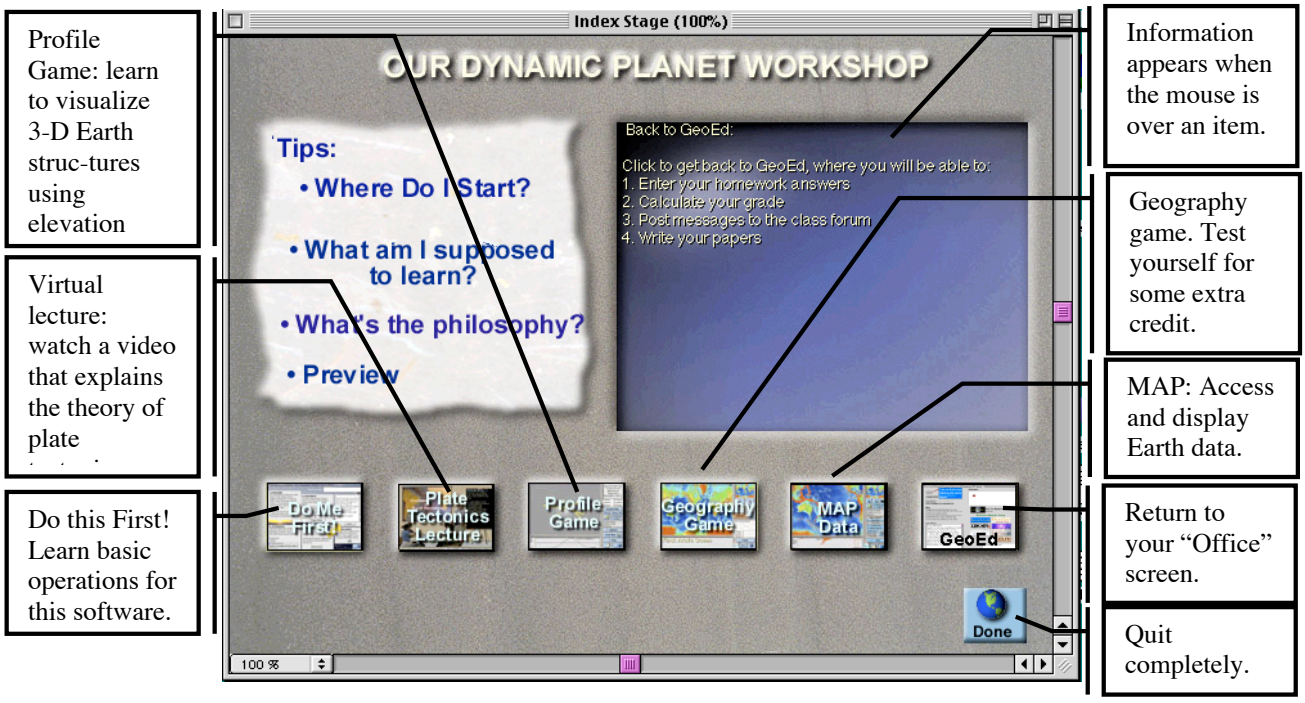

Figure 11. Workshop screen. This is an index of the tools that are available to you.

Move the mouse over the icons along the bottom of the screen to display the purpose of each of the tools. The Plate Tectonics Lecture is the same video that you will see in class. However, it is broken into segments so that you can repeat any portion that you find confusing. The Profile Game helps you focus on aspects of the elevation profile that you will need to effectively interpret the MAP data. The geography game was created for students who have not had experience recognizing important geographic features on a world map. It will review the oceans, continents, seas, and other features of interest to marine geologists. The MAP tool is where you access and display the Earth data for your tectonics paper. The Graphics Workshop allows you to

edit and print images that you capture using the MAP tool. You can also use the Graphics Workshop to create your own drawings. You can print the drawings and copy them to a floppy disc or zip disc, so you can use them on your own computer.

The software tools are easy to figure out. The key tools will be discussed in more detail below.

Be sure to notice "rollover help" at first to familiarize yourself with the function of each button. On most of the screens in this section, the help message is shown in a text field at the upper right corner.

The Plate Tectonics Lecture

The plate tectonics lecture will let you, at your leisure, view an animated explanation of the theory of plate tectonics. You can also access interesting information about volcanoes. Figure 12 shows the computer screen for this tool. The controls on this tool are very straightforward. You can advance the slide projector forward and backward, or select a slide randomly. In addition, the "Topics" menu allows you to access other short narrated lectures of interest about volcanoes. Access these lectures using the popup menu as shown in Figure 12.

When you are finished watching lectures, click the "Return" button and you will get back to the workshop.

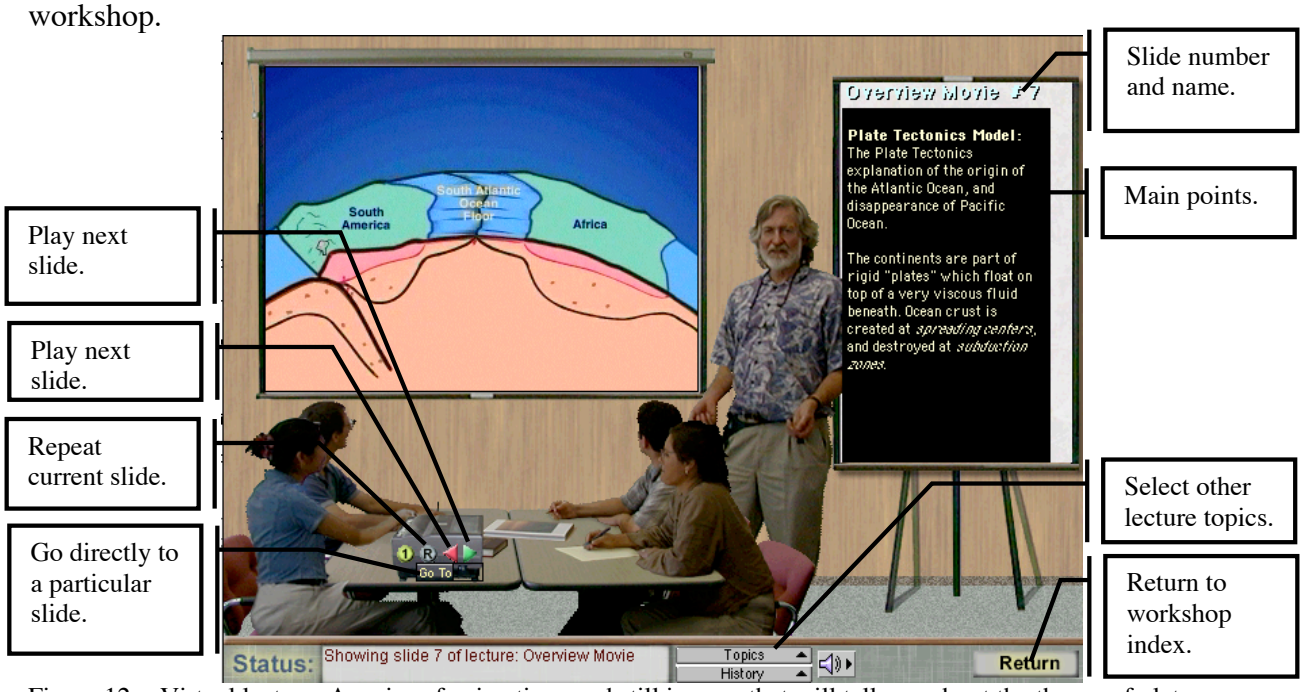

Figure 12. Virtual lecture. A series of animations and still images that will tell you about the theory of plate tectonics and interesting facts about volcanoes.

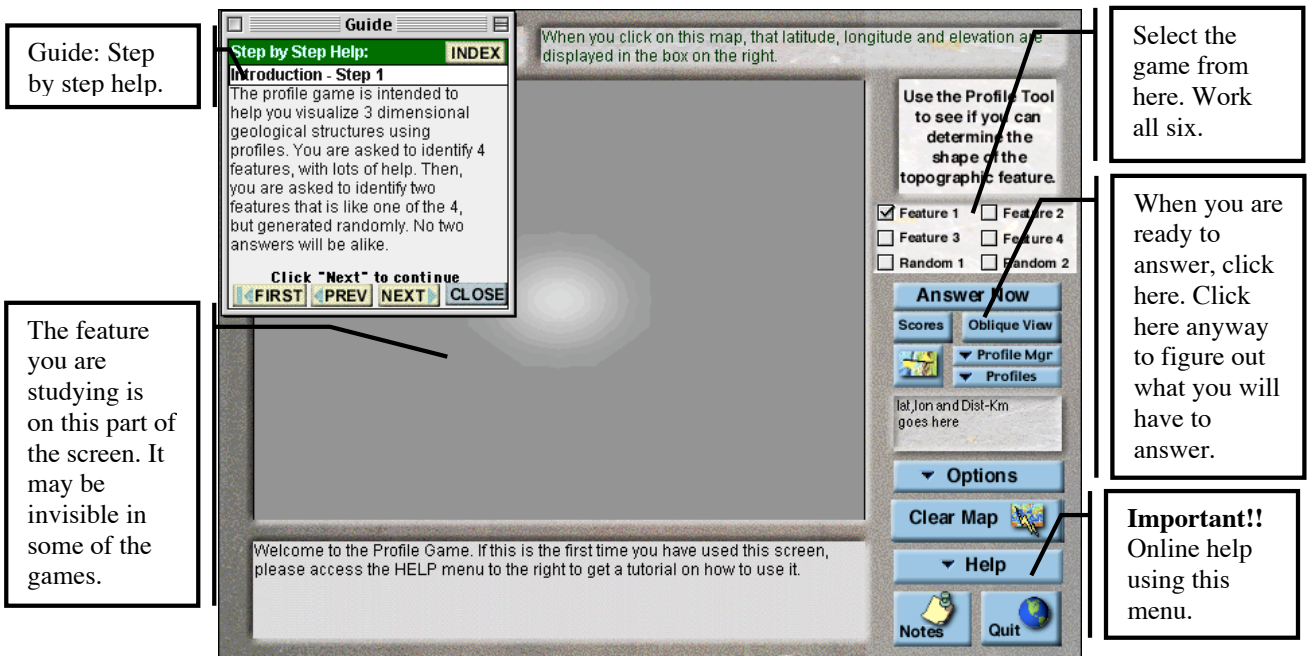

Figure 13. Profile Game. This game has been designed to help you understand how to classify geological structures using elevation profiles. Note that the button labels show up a bit differently than those in the main EarthEd modules. Watch the text field in the upper right hand corner of the screen while you move the mouse over the various buttons.

The Profile Game Screen

The “Profile Game” is extremely important. It will help you understand how to use profiles when you get to the MAP tool, where you must use them to identify geological features for your study the topography of the Earth. The point of the game is to find the unknown feature and answer some questions about its dimensions and shape.

To get to the Profile Game from the "Our Dynamic Planet Workshop," click on the “Profile Game” button. When you get to the screen shown in Figure 13, take a moment to notice its help features. When you move the mouse over a button, its function is explained in a text field at the upper right of the screen. Notice the "Help" pop up menu near the lower right. You can bring up the "Guide" window, or an animation that helps you visualize what an elevation profile represents.

Important features to notice: This screen (Figure 13) shows several important features of this software. First is the "Guide" window. The Guide give you step by step instructions on how to use each of the tools on the CD. You can click on the "Index" button (on the Guide) to see a list of particular tool features that you might want to use. Another important feature of the screen is the "rollover" help you get when you move the mouse over the buttons. This can help to remind you what each button does. In addition, the "Help" pop up menu brings up the Guide after you close it to get more room on the screen.

Profile Game Rules:

You may select from six possible games. The first four games are designed to make it easy for you to succeed, and to learn the game. The “Random” features are a bit more difficult. After you score the random game, you can continue entering new answers, but they will not be scored. **You only get one chance on each random game, but the game allows you to generate new random games for "Random 1" and "Random 2," and try again. The highest score is the**

one that applies for your grade. Click the "Scores" button to see your current highest scores.

The "Guide" window"

The Guide is your most powerful online help. You can use it to learn how each of the software tools can be used. It even points out interesting tectonic features in the MAP software. The guide only lists topics relevant to the tool that you are currently using.

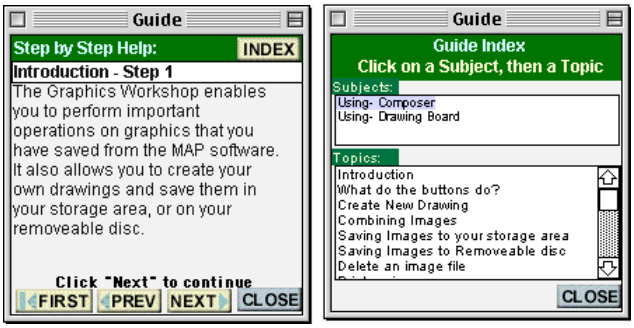

Figure 14. This shows two views of the "Guide" window.

The view on the left (Figure 14) is displayed when you load a tool that has a Guide. It is set at a general introduction for that tool. Click the "Next" button to go through a series of steps that orient you. For a more comprehensive set of instructions, click the "Index" button on the upper right, and a list of topics will be displayed in the top text box. When you select a topic, a list of short subjects under that topic will be displayed in the lower text box. Select a subject to bring up the information.

The Geography Game:

The Geography Game is intended to help you review basic Earth geography. It will help you learn to recognize important earth features from a world map. The fifth game is a challenge. It has so many features that it will be very difficult to get all of them correct.

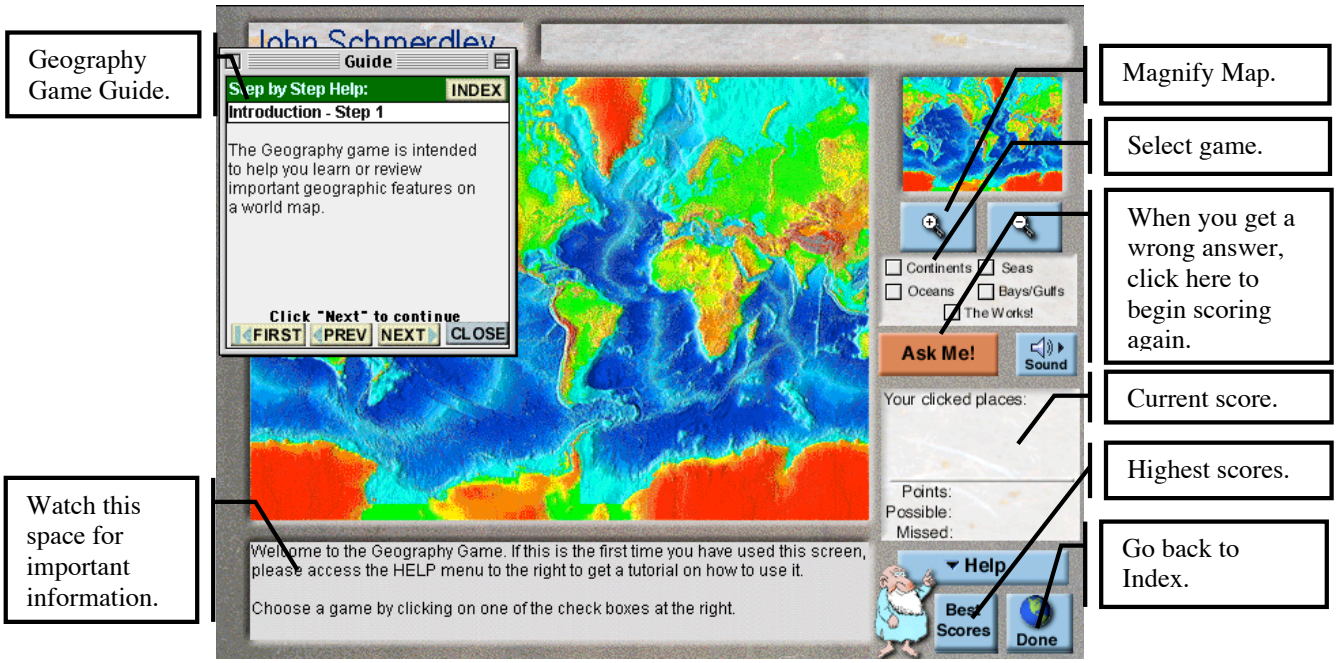

Figure 15. Geography Game. Use this game to review your knowledge of geography. You must be able to identify the continents, oceans, and seas from a world map. This makes it fun.

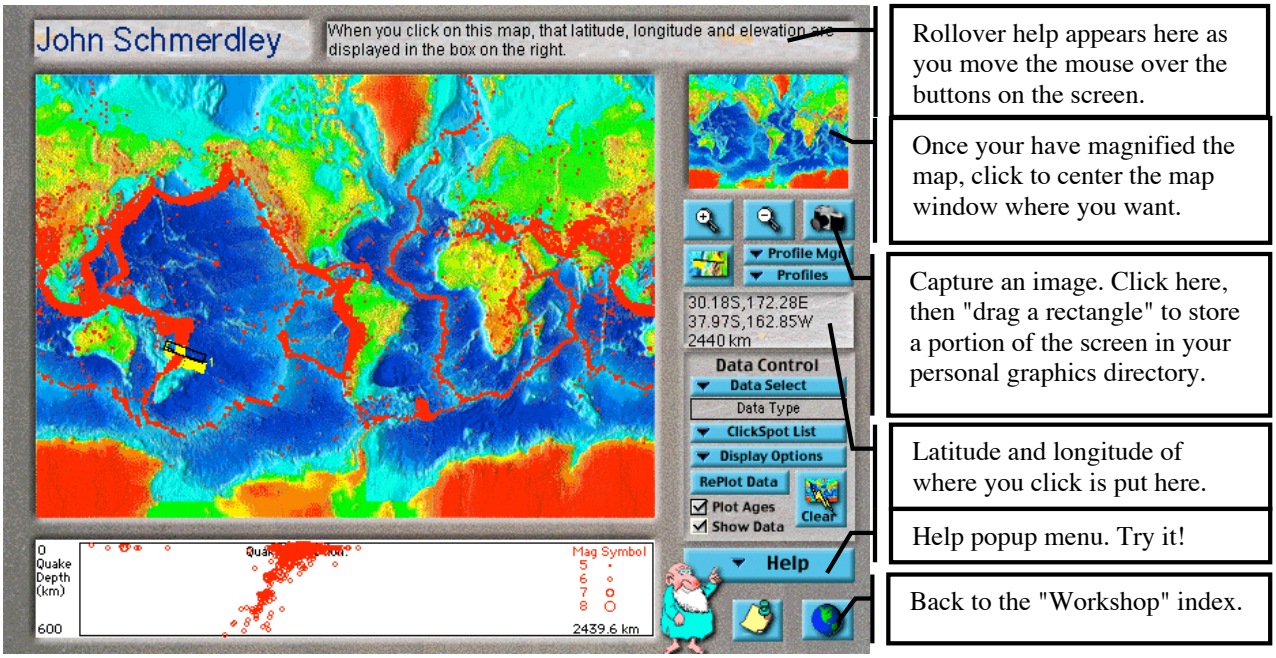

Figure 16. Map. This is the access center for acquiring and plotting Earth data. Notice the "Rollover Help" to find out what each button and field means. Please read it carefully. Notice the “Help” popup menu, which gives you a choice of various kinds of help and information.

The Map Screen:

The most important software tool is the MAP tool. It enables you to access all of the geological data that you will need for your science paper. By simply clicking the mouse, you will be able to make profiles of the topography, plot volcano and earthquake locations, and view movies and photos of interesting Earth features. Figure 16 shows this screen.

The map screen is best learned from its help features. Balloon help and the tutorial movie under the “Help ” button will allow you to explore the function of each of the buttons. The most powerful help feature is the set of tutorial movies available from the "Help" popup menu. The Guide also provides detailed help and even points out interesting map features. Choose whichever help is most effective for you.

Caution: The profiles are generated from a topographic database (called ETOPO5, referenced in lab section #3 write-up). It does vary in quality and may be wrong or lack detail in certain regions. For example, since it averages over approximately 5 mile squares of the surface, sharp mountain peaks will not show up, since their height will be averaged with surrounding lower elevations. **The volcano database is also limited.** It is a compilation by the Smithsonian Institute and is the best available. However, it does not contain any of the multitudes of invisible volcanoes that we know are on the seafloor.

The following are some of the most important operations available in the Map software.

Latitude and Longitude:

A location on the map is determined by its latitude and longitude. When you click on a spot on the map, the latitude, longitude, and depth are displayed in a text box. Be sure you can use this, as it is very useful in describing your results and determining locations.

Magnifying and Scrolling the Map:

There are two magnifying glass icons on buttons at the upper right. Click on one and the cursor will change to a magnifying icon. Move the cursor over the point you want to magnify and click. The map will expand, with the clicked point at its center. The second magnification causes a rather large map to be loaded, which will take awhile. However, this is the way you get the most resolution. To scroll the magnified map, you click on the small index map at the upper right. Try it!

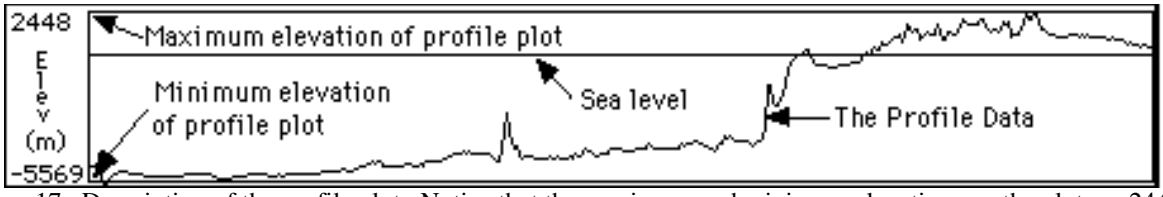

Figure 17. Description of the profile plot. Notice that the maximum and minimum elevations on the plot are 2449 and -5569 meters. Sea level is at 0 meters, which is shown as a solid line. The length of the profile is 1,000 km. Notice the distance is in kilometers and the elevation is in meters.

The Profiles:

A profile is made by first clicking on the "Profile" button, then at the two locations on the map that define the start and end of the profile you want. The profile button is the one on the right, with the small line plot on it. You can make as many of these profiles as you want. All profiles are saved and can be plotted at any time. You access previous profiles using the popup menu to the right of the profile button. It is possible to plot more than one profile on the plot, but you must turn off the automatic scaling of the plot first.

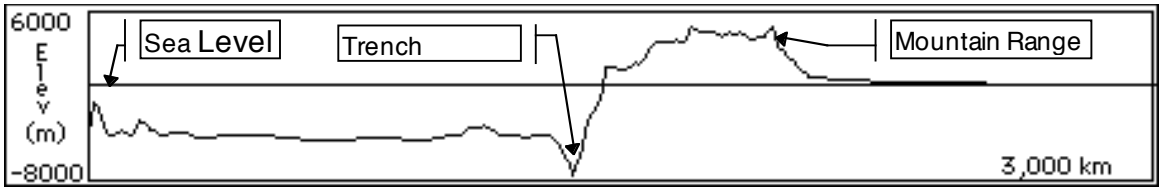

Figure 18. This is a profile where the scales are manually set. The depths range between +6000m and -8000m. The distance of the plot is 5000 km, but the profile is not that long.

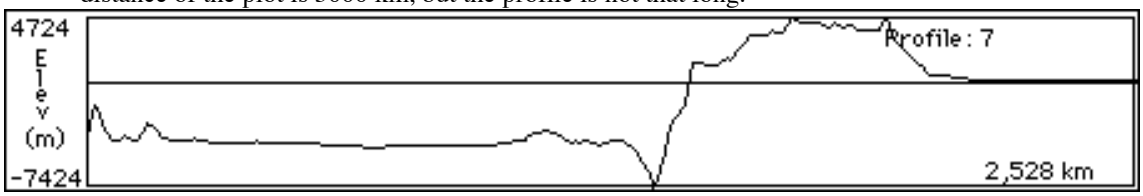

Figure 19. This is the same data of Figure 12, but plotted with auto scaling. Since the auto scaling sets the plot limits equal to the data limits, we can see that the maximum height is 4724m, the maximum depth is -7424m, and the length of the profile is 2,528 km.

When you plot profiles over the ocean, you will notice that the seafloor age is also plotted. The portions of the profile on land do not have ages in the database, so age is not plotted.

The Profile on the line of the Great Circle Path:

The great circle path between the two endpoints of the profile is plotted on the map. The profile plot is plotted using this path as the plot axis. This will be called the "GC profile." The path is drawn in black and the profile is in red. The purpose of this plot is only to locate general features, not to determine the actual depths. The GC profile is scaled to the maximum values. The GC path (black line) is 0 depth (sea level). If the profile is below the line, the depth is

negative, which indicates a region covered by water. If the maximum depth is 6000 meters, then the maximum amplitude of the GC profile will correspond to the 6000 m depth. This distance is set to 15 pixels (the smallest unit of Macintosh screen resolution) by default (it can be changed using the "Scales on Great Circle Path" choice on the "Scales" popup menu). But, if the maximum depth is 100 meters, the maximum amplitude of the GC profile will still be 15 pixels. So, the GC profile plot for a constant depth of 6000 meters will look precisely the same as a GC profile plot for a constant depth of 100 meters. To determine actual depth values, use the profile plot at the bottom of the screen, or click on the location where you want the depth and read its value from the text box.

Selecting Data to be drawn on the map:

The type of data to be plotted is selected in the "Data:" pop up menu. You must also make sure that the "Show Data" box is checked.

The Volcanoes:

You can plot the volcanoes by selecting "Volcanoes" data from the "Data" pop up menu. Remember that the large number of volcanoes on the seafloor are not shown because most of their locations are not precisely known. When you click on the symbol for a volcano, wait until the cursor returns to normal, and information about that volcano appears in a box below the map.

Earthquakes:

You can plot earthquake hypocenters by selecting "Quakes" in the "Data" pop up menu. The quakes are all quakes greater than magnitude 5.0, which have been measured by the world-wide network of seismic stations operated by many organizations who report their measurements to the National Geophysical Data Center in Boulder, Colorado. Earthquake hypocenter cross-sections can be plotted by first making a profile line where you want the cross-section. Then click on "Replot Data" (Earthquake data must be selected) and the quake database will be searched. When it is done plotting, or when you hold down the mouse button, the cross-section plot will be created. Quakes that are included in the cross-section plot are plotted in yellow on the map.

Note: The cursor shows the year of the data being plotted. To stop earthquakes from plotting, hold down the mouse button until plotting stops.

Heat Flow:

Select "Heat Flow" from the data selection menu. You will see a grid of small red squares appear on the map. Click on any square to get its heat flow value displayed in the box below the map. The most useful way to use the heat flow data is by plotting a profile of values. You can get a profile of heat flow data the same way earthquake profiles are plotted. First, make a topographic profile between the points for your desired heat flow profile. Make sure you have selected "Heat Flow" from the data selection menu. Then click on the "Update" button. A box will be drawn around the profile line and heat flow values within it will plot as yellow. A profile of heat flow values will then be plotted in the box below the map.

The Click Spots:

Select "Click Spots" from the "Data:" menu. When you click on one of these dots, a database of images and movies is accessed. Movies "linked" to the spot you clicked on will show up in the "ClickSpots" pop up menu. Select one and it will appear. To close a movie, click on the close box on the upper left corner of the window. To close a graphic, just click on it and it will

disappear. **Black rectangles** on the map indicate a figure that spans approximately the area of the rectangle. Click inside it to access the figures linked to it.

Area Maps:

Select "Area Maps" from the "Data" menu. A number of black boxes will appear. These define the boundaries of each area map. Click inside one of the boxes, then select the map from the "ClickSpots" pop up menu. A detailed area map will appear. You can then plot volcanoes, quakes, or click spots on this map. To return to the base map, select "Base Map" from the "Data" menu.

Place Names:

Select "Place Names" from the "Data" menu. A lot of rectangles will show up on the map. These rectangles approximately enclose important Earth features. Click inside of one of them and use the "ClickSpots" menu to see the names of the enclosed features.

How to:

*** Get the maximum and minimum depths on a profile**: When you make a profile, the plot is scaled to the maximum and minimum depth of the profile. Just read it off of the plot.

*** To set the maximum and minimum depth on a profile plot to specific values:** You might want to do this if you want to compare different profiles. Autoscaling could make comparisons between profiles difficult to visualize. From the "Display Options" popup menu, select "Elevation Plot." Then enter the maximum and minimum values into the indicated boxes. Notice that the "Auto Scale" checkboxes become unchecked. To return to auto scaling of the profile plot, come back to this dialog and set the autoscale check boxes for each of the axes.

*** Put more than one profile on the depth plot**: Select “Elevation Plot” on the “Display Options” popup menu and click in the “Multiple Plots” box. You must not have any of the “Auto Scale” boxes checked. This assures that each profile has the same scale on the plot.

*** Get the depth at a place on the map**: Click on the place you want the depth. It will be displayed in a field to the right of the map.

*** Get the length of a profile, in km**: The length of the profile is always displayed in the box to the right of the “Budget” button. You can tell what it is because its units are km.

*** To save an image from the MAP screen:** Display the data the way you want it. Click on the "Camera" icon. Then move the mouse over the upper left hand corner of the rectangle you want to capture. Hold the mouse down. Drag the mouse (moving the mouse without letting up on the mouse button) to the lower right corner of the rectangle you want. Note that a square bounding box is drawn. If this box does not start at the corner you specified, you need to hold the mouse down a bit longer before dragging it. When you lift the mouse, you will be an upload screen, where you will follow the progress of your image being uploaded to your personal graphics storage library. Follow the directions carefully.