

GEO/OC 103

Exploring the Deep...

Lab 1

Using ArcMap

Launching ArcMap and opening project files

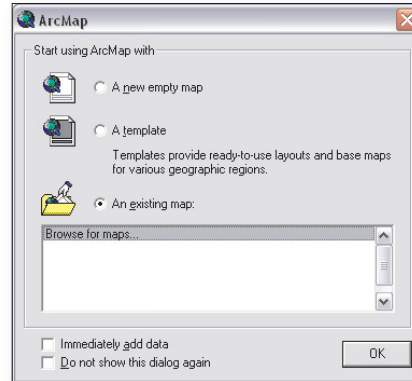
ArcMap shortcuts

In addition to the Start menu, an ArcMap shortcut may have been placed on the desktop or taskbar for your convenience.

Why doesn't the ArcMap startup dialog box appear?

If someone has checked the **Do not show this dialog again** checkbox, it will no longer appear each time you launch ArcMap.



- To launch the ArcMap application, click the Start button on the Windows Taskbar and choose **All Programs > ArcGIS > ArcMap** (ArcMap).
- If you see the ArcMap dialog box, choose **Browse for file** under the **An existing map** option.



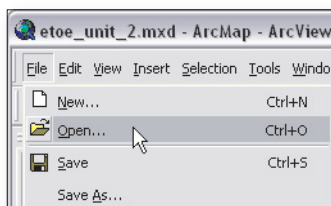
- Choose **File > Open**.
- Navigate to the appropriate unit data folder installed on your local hard drive or server and open it. (Your instructor or lab administrator can tell you where to find the investigation folders.)
- Locate the specified ArcMap document file and open it. (The .mxd file extension may or may not be visible, depending on how the computer has been set up.)

Visual cues

Visual cues are used to make the investigation directions easier to follow.

- Text preceded by a computer symbol  is an instruction—something to do on the computer.
- Names of tools or buttons are capitalized and are followed by a picture of that item as it appears on screen—for example, the Identify tool .
- The > symbol between boldface words or phrases in text indicates a menu choice. Thus, **File > Open...** means “pull down the File menu and choose Open...”

“File > Open...” means...



What if I click “Yes”?

Don't worry if you click **Yes** when you close a map file. The files have been locked to prevent you from accidentally modifying them.

Sidebars contain important information!

The page sidebars contain useful information such as definitions, explanations, illustrations, examples, reminders, warnings, tips, and hints. If you are not sure what to do, look for help in the sidebar first.

Closing map files

When you have completed an investigation or must stop for some reason, choose **File > Exit** and click **No** when asked if you want to save your changes.

The ArcMap User Interface

Title Bar
Shows the name of the current map file.

SAGUARO Tools
Tools provided by the SAGUARO Project for these materials. Note: This toolbar may appear in a different location.

Menu Bar
Provides menus for performing various operations.

Toolbars
Tools for manipulating and analyzing map data.

Table of Contents
A list of data frames and map layers, and controls for changing the map view.

Status Bar
Displays tool descriptions, measurement results, and other information about the current operation.

Data Frame
The currently-selected map.

Coordinates
Displays the coordinates, in the currently-selected units, of the cursor position.

Basic display operations

Activating a data frame

To activate a data frame, right-click its name and choose Activate from the pop-up menu. The title of the activated data frame is highlighted bold.

Expanding and collapsing data frames

To expand a data frame and show its layers, click the expand box (+). To collapse a data frame and hide its layers, click the collapse box (-).

Selecting layers or layer groups

To select a layer or layer group, click the layer or layer group name. Selected layers or layer groups are highlighted. To select multiple layers or layer groups, hold down the control key while clicking additional names.

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- Ocean Floor Topography
- Once and Future Oceans** (Active data frame)

Layer Groups

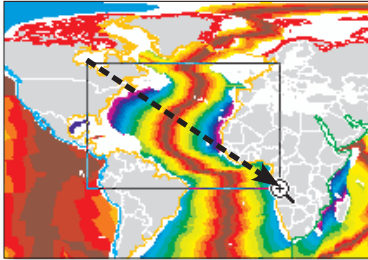
- The Future
- The Present
- Present Atlantic Ocean

Layers

- Present Labels
- Present Continents** (Selected layer)
- Present Land
- Permian
- Cambrian
- Precambrian





Zooming

The most efficient way to zoom in on a specific area is to drag a box around the area using the Zoom In tool. Drag diagonally from one corner of the area to the opposite corner, then release the button.



Zooming

ArcMap has tools for zooming—enlarging and reducing areas of the map—that work like the tools you have used in other applications.

- To zoom in on an area, click and drag diagonally with the Zoom In tool  to outline the area on the map. When you release the button, the area you selected will rescale to fill the data frame window.
- To zoom out, click anywhere on the map with the Zoom Out tool .
- If you zoom in or out so far that you do not know where you are, undo previous zooms by clicking the Previous Extent button .
- To view the entire data frame, click the Full Extent button .

Want to know more?

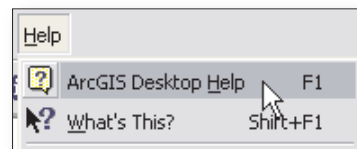
If you would like to know more about using ArcGIS, download the **Guide to ArcGIS.pdf** from:

<http://www.thomsonedu.com/earthscience/hall/ocean>

Troubleshooting and support options

ArcGIS help

This module provides all of the directions you need to complete the investigations using ArcGIS 9.x. If you have other questions about the capabilities of ArcGIS, choose **Help > ArcGIS Desktop Help**.



Troubleshooting

The current version of the troubleshooting guide for this series (**Troubleshooting.pdf**) is available from the Instructor Resource Center at:

<http://www.thomsonedu.com/earthscience/hall/ocean>

Technical support

If you experience problems with these materials, contact the Thomson Learning technical support team at:

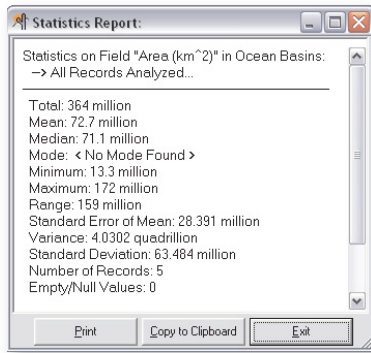
tl.support@thomson.com

1-800-4230563

Investigation data, updates, and resources

Investigation data, updates, and additional resources related to the *GIS Investigations for the Earth Sciences* series can be downloaded from:

<http://www.thomsonedu.com/earthscience/hall/ocean>



Working with large numbers

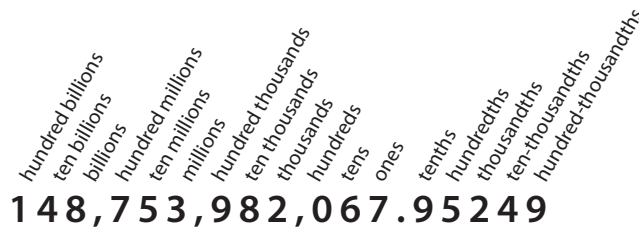
Some of the numbers you will work with in these investigations are quite large. When talking about the amount of water in the ocean or the energy of an earthquake or hurricane, you routinely use values in the billions or even trillions. Where possible, ArcGIS has been modified to make these very large and very small numbers easier to read. For example, in the Statistics Report window shown at left, the total area is given as 364 million, rather than 363958342077361 square kilometers.

Occasionally, you will need to convert millions to billions or thousands, or vice versa. For example, to convert the **Mean** value in the window at left from millions to billions, move the decimal point three places to the *left*. To go from millions to thousands, move the decimal three places to the *right*.

$$72700 \text{ thousand} = 72.7 \text{ million} = 0.0727 \text{ billion}$$

Rounding

Most of these numbers are approximations, so it does not make sense to be overly precise when you are calculating or recording them. Look at the number written below, and the place value of each of the digits. Face it—when you are talking about nearly 149 billion of something, who cares about hundred-thousandths, or even tens of millions?



Rounding examples

For example, if your number is

319,740,562.85

To round to the nearest ten million:

- Find the ten millions digit (1).
- Look at the number to its right (9). Because it is between 5 and 9, add one to the ten millions digit to make it 2.
- Change the whole numbers to the right of the ten millions digit to zeros and drop the decimal point and everything to its right. The result is **320,000,000**.

Rounding to the nearest . . .

- ...million (1,000,000) = **320,000,000**
(adding 1 to 319 gives 320)
- ...hundred thousand (100,000) = **319,700,000**
- ...ten thousand (10,000) = **319,740,000**
- ...thousand (1,000) = **319,741,000**
- ...hundred (100) = **319,740,600**
- ...ten (10) = **319,740,560**
- ...one (1) = **319,740,563**
- ...tenth (0.1) = **319,740,562.9**

To round to the nearest 0.1 million:

- Find the 0.1 millions digit (7). This is also called the hundred thousands digit.
- Look at the number to its right (4). Because it is between 0 and 4, do not add one to the 0.1 millions digit.
- Insert the decimal point in the proper location. The result is **319.7 million**.

Throughout these investigations, you will be asked to round answers to a particular value and number of decimal places, such as “Round your answer to the nearest 0.1 million.” Rounding numbers is simple, if you follow these steps. Examples are shown at the left.

- Look only at the numeral to the right of the place value you are rounding to. For example, when rounding to the nearest thousand, look only at the numeral in the hundreds place.
- If the numeral to the right is 0-4, do not change the number you are rounding to. If the number to the right is 5-9, add one to the number you are rounding to.
- Change whole numerals to the right of the place you are rounding to into zeros, and omit all unused decimal places.
- For any number less than 1, include a zero to the left of the decimal point. (Instead of *.79 billion*, write *0.79 billion*.)

Rounding decimal fractions

Rounding decimals works the same way, except that you are rounding to tenths, hundredths, thousandths, and so on. Do not add zeros to the right of the decimal point. In other words, rounding 2.587 to the nearest tenth is 2.6, *not* 2.600.

Estimating percent area

You will occasionally be asked to estimate the percent area covered by land, ocean, or some other feature. This is a difficult skill for some people to master, but can be learned with practice.

Comparing to standards

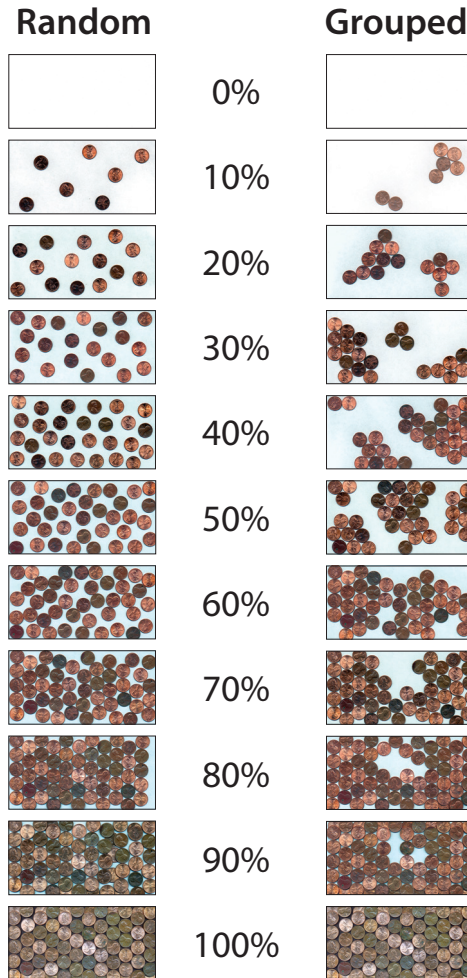
One method of estimating coverage is to compare to visual standards. When estimating coverage you need to consider how the features are arranged.

Cloud cover exercise

Here is a simple activity that demonstrates the confusing nature of cover estimates.

- Take two full sheets of blue paper and one of white paper. The blue paper represents sky, and the white paper represents clouds.
- Cut the white sheet in half. Tear or cut the first half of the white sheet into large pieces and glue them onto one of the blue sheets without overlapping.
- Repeat the step above with the other half of the white sheet and the other blue sheet. This time, cut or tear the white sheet into small chunks before gluing them on.

In both cases, the cloud cover is 50 percent. Half of the blue sky is covered by white clouds, but the sheet covered by large clouds appears more open than the sheet covered by small clouds.



Gridding

Another approach to estimating coverage is to divide the area up into a grid, either mentally or physically, and determine the number of grid squares that are at least half-covered. To find the percent coverage, calculate the ratio of covered squares to total squares and multiply by 100.

In the example at left, approximately 20 of the 50 squares are at least half covered.

$$20/50 \times 100 = 40\% \text{ coverage}$$



Philosophy & design

Philosophy

Thinking scientifically

An Earth scientist makes a living by observing and measuring nature. Whether recording and analyzing earthquakes or measuring subtle changes in sea surface temperature over many decades, a successful Earth scientist relies heavily on his or her ability to recognize patterns. Patterns in space and time are the keys to many of the great discoveries about how Earth works. The investigations in this series are designed to help you develop your ability to recognize and interpret nature's fundamental patterns by exploring recent scientific data using a computer and geographic information system (GIS) software.

What is a GIS?

GIS provides tools for organizing, manipulating, analyzing, and visualizing information about the world using digital maps and databases.

Most of these patterns are presented through maps, which are among scientists' most important tools. Maps allow you to visually explore spatial relationships between phenomena such as surface winds and ocean currents; natural features such as continents and ocean basins; and human features such as countries and cities. Behind each map layer is a table containing an extensive database of information about each feature in that layer. By carefully analyzing these data, you can identify patterns in the data that are difficult to discover through visual examination alone.

Planning to learn

Each unit of the series leads you through a well-tested learning process that builds upon your existing knowledge. Each unit begins with a warm-up exercise designed to stimulate your thinking about the major concepts presented in the unit and the key questions that motivate and guide scientific research. It will help you frame your own questions about the topic—questions that you may be able to answer for yourself as you learn more in later investigations.

In the first investigation, you will explore maps and data looking for patterns. As you examine these patterns, you should ask yourself questions such as:

- Where do they occur? (or not occur?)
- Why does this pattern occur here and not elsewhere?
- What might cause this pattern?
- What else is spatially associated with this phenomenon?
- Do these things usually occur together in the same places?
- How has this pattern changed spatially through time?

A brief reading provides key background information about scientific principles and concepts, and should help you begin to answer the questions raised earlier.

Finally, in one or more additional investigations, you apply your new knowledge to solve a particular problem. This helps you measure your understanding of the material and apply the concepts you have learned to a new location or situation.

GIS made easier

The purpose of these investigations is not simply to learn how to use GIS, but to use one as a tool to explore and learn about natural processes and features and how they relate to humans and human activities. For this reason, all of the data have been assembled into ready-to-use projects, and complex operations have been eliminated or simplified. Although it is helpful for you to have basic computer skills, you do not need experience with ArcGIS software to complete the investigations. The ArcMap user interface has been modified to simplify complex and repetitive processes. Directions for each task are provided in the text, so you will learn to use the tool as you explore with it. The investigations barely scratch the surface of the data that have been provided, and we encourage you to explore the data on your own.

The 5-E Learning Cycle

Engage (Warm-Up)

This stage is designed to help you understand the learning task and make connections to past and present learning experiences. It should stimulate your interest and prompt you to ask your own questions about the topic.

Explore (Investigation)

In this stage, you investigate key concepts by exploring scientific, geographic, and economic data sets. You begin identifying patterns in the data and connecting them to Earth processes. This further stimulates curiosity and new questions develop. You may diverge from the written investigation to explore your own questions, continually building on your knowledge base. Through this process of questioning and exploration, you begin to formulate your understanding of basic concepts.

Explain (Reading)

This stage introduces you more formally to the lesson's scientific and geographic concepts. You should gain a better understanding of major concepts, acquire important terminology, and verify answers to questions or problems posed earlier. In addition, more abstract concepts not easily explored in earlier activities are introduced and explained.

Elaborate (Investigation)

In the Elaborate stage, you will expand on what you have learned and apply your newfound knowledge to different situations. You will test ideas more thoroughly and explore deeper relationships.

Evaluate (Wrap-up)

At the end of each unit, you will use your understanding of key concepts to propose explanations and solutions to local or regional problems.

Instructional Design: The 5-E Learning Cycle

This series was designed using the 5-E learning cycle model, which promotes inquiry and exploration as a process for learning science. The Learning Cycle, originally credited to Karplus and Thier (*The Science Teacher*, 1967) and later modified by Roger Bybee for the Biological Sciences Curriculum Study (BSCS) project, proposes that learning something new or understanding something familiar in greater depth involves making sense of both prior experience and firsthand knowledge gained from new explorations. The 5-E model divides learning experiences into five stages: Engage, Explore, Explain, Elaborate, and Evaluate. Each stage builds on the previous stages as you construct new understanding and develop new skills.

Learning science with GIS

Geographic Information Systems (GIS) provide an ideal vehicle for learning topics in Earth and environmental sciences and helping you develop scientific problem-solving skills. Formerly limited to professionals with access to high-end computer workstations, today GIS is accessible to many, and is being used by students from elementary through graduate school. GIS has a number of advantages over traditional materials when used as an instructional tool. These include:

- **Data visualization**—GIS-based investigations allow you to identify and characterize relationships by manipulating multiple visual representations of data, including dynamic and customizable maps, tables, charts, and animations.
- **Data analysis**—Analytical tools enable you to quantify relationships within and among spatial data sets using database functions, statistical analyses, and spatial overlay operations.
- **Multimedia integration**—Other forms of digital information, including animations, video, audio, and digital stills, can be woven into GIS activities, greatly enriching and extending your learning experience.
- **Technology literacy and transferable skills**—The use of GIS promotes technology literacy and provides you with skills transferable to your own research, other course work, and the workplace.

GIS-based instructional materials have the potential to enhance your learning by reinforcing concepts through discovery and by improving problem solving, visualization, and computational skills.

Tear out this sheet for easy reference to common ArcMap operations.

GIS Investigations for the Earth Sciences

Quick Reference Sheet

The ArcMap User Interface

Menu Bar
Provides menus for performing various operations.

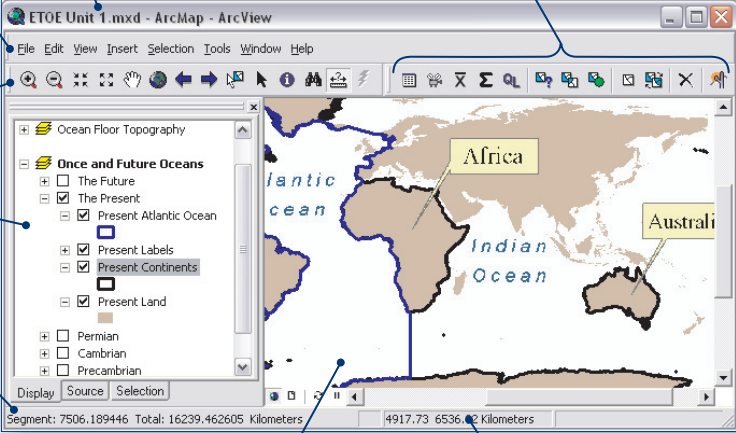
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Shows the name of the current map file.

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The currently-selected map.

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Basic display operations

Activating a data frame

To activate a data frame, right-click its name and choose Activate from the pop-up menu. The title of the activated data frame is highlighted bold.

Expanding and collapsing data frames

To expand a data frame and show its layers, click the expand box . To collapse a data frame and hide its layers, click the collapse box .

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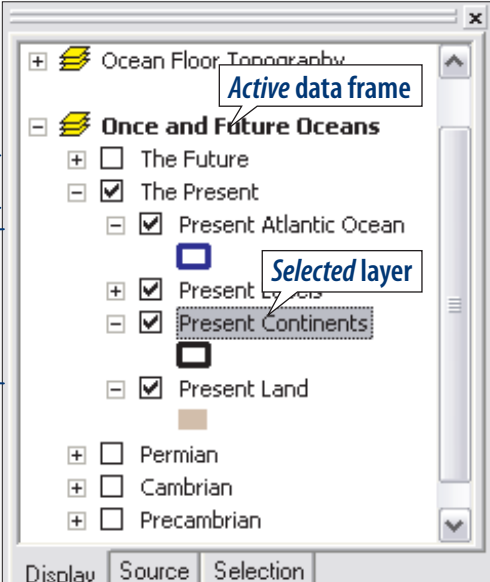
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- The Future
- The Present

Layers

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- Present Continents (Selected layer)
- Present Land
- Permian
- Cambrian
- Precambrian

Display Source Selection


Tear out this sheet for easy reference to common ArcMap operations.

Opening ArcMap document (.mxd) files

At the beginning of each investigation, you will launch the ArcMap application and use it to open an ArcMap document file.


The instruction will look like this:

 Launch ArcMap, and locate and open the **etde_unit_1.mxd** file.

 ArcMap document files end with an .mxd file extension. Depending on how your computer has been set up, file extensions may not be visible, so the above file may appear as simply **etde_unit_1**. (Note: We will also refer to ArcMap document files simply as *map files*.)

Launching ArcMap

To launch the ArcMap application, click the Windows Start menu and choose **All Programs > ArcGIS > ArcMap**.

 Note: If there is an ArcMap shortcut icon on the desktop, Start menu, or taskbar, you can also use it to launch ArcMap. It may or may not show the .exe file extension. Your instructor or lab administrator may provide you with alternate directions for launching ArcMap.





Locating and opening the EXXX_Unit_X.mxd file

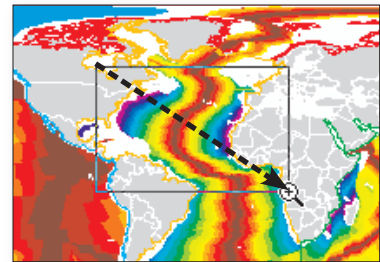
Choose **File > Open...** and navigate to where the specified ArcMap document file is located. Your instructor or lab administrator should tell you where the investigation data files are located. They will be in folders named with the module abbreviation and unit number, such as ETDE_Unit_1. Remember, you may not see the .mxd file extension.

Important note: Do not call or e-mail technical support if you cannot find an ArcMap document file. Your instructor or lab administrator can tell you where to find it!

Zooming

ArcMap has tools for zooming—enlarging and reducing areas of the map—that work like the tools you have used in other applications.

- To zoom in on an area, click and drag diagonally with the Zoom In tool  to outline the area on the map. When you release the button, the area you selected will rescale to fill the data frame window.
- To zoom out, click anywhere on the map with the Zoom Out tool .
- If you zoom in or out so far that you do not know where you are, undo previous zooms by clicking the Previous Extent button .
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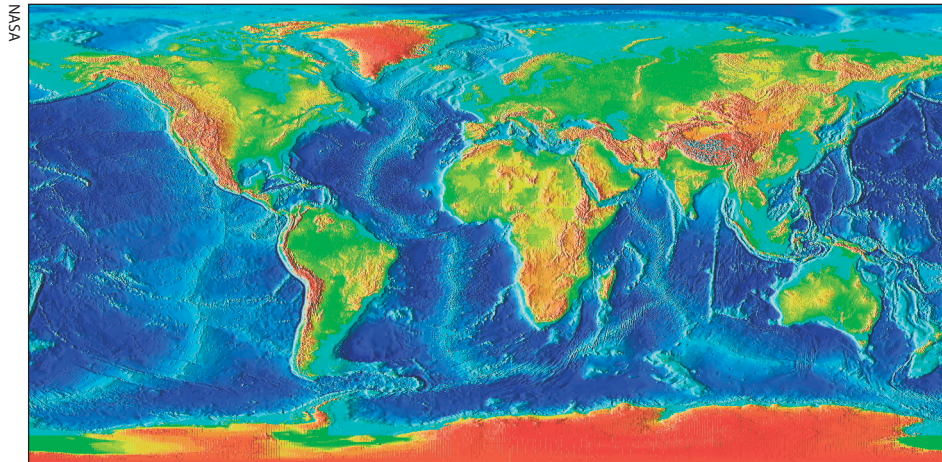
tl.support@thomson.com or 1-800-423-0563

Unit 1

The Ocean Basins

In this unit, you will

- *Track changes in the world's continents and ocean basins from 750 million years in the past to 250 million years in the future.*
- *Contrast the extent and age distribution of ocean floor and continental crust and hypothesize about their origins.*
- *Investigate the origin of deep ocean basins.*
- *Create bathymetric profiles of an ocean basin at various resolutions.*
- *Examine surface features that reveal the dynamic nature of the ocean basins.*



Surface features of ocean basins show that the ocean floor is constantly changing.

Investigation 1.4

bathymetry (buh-THIH-muh-tree) — measure of water depth in basins such as lakes, oceans, and rivers. *Bathy-* comes from a Greek word for *depth*, and *-metry* comes from another Greek word meaning to *measure*.

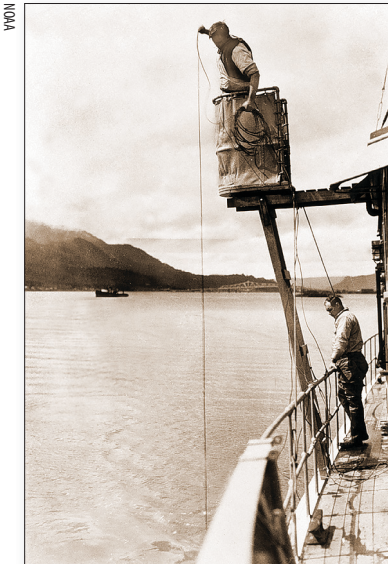


Figure 1. Manual depth sounding with a weighted cable. It was difficult to obtain accurate depth measurements this way. Sometimes, it was hard to determine the exact location of the ship, to ensure that the line dropped straight down, and to know when the weight hit the bottom.


Beneath the waves

For most of human history, the ocean's surface has been a forbidding boundary, separating the known from the unknown. Except for the tiny amount of the ocean floor visible in shallow water, people had no idea what lay beneath the waves.

Today, we have the ability to gather detailed information about the age, composition, and other characteristics of the ocean floor. This knowledge is critical for understanding the processes that shape Earth's surface. In this activity, you will investigate the *bathymetry* of the ocean basins to more fully understand the features of the ocean floor and the processes that shape them.

The five ocean basins

Over 70 percent of Earth's surface is covered by a single, interconnected body of water that is somewhat arbitrarily divided into five basins—the Arctic, Atlantic, Indian, Pacific, and Southern Oceans. Next, you will examine the location, size, and depth of each ocean basin.

 Launch ArcMap, and locate and open the **etoe_unit_1.mxd** file.


Refer to the tear-out Quick Reference Sheet located in the Introduction to this module for GIS definitions and instructions on how to perform tasks.

 In the Table of Contents, right-click the **Ocean-Floor Topography** data frame and choose Activate.

 Expand the **Ocean-Floor Topography** data frame.

This data frame shows the ocean basins, each outlined in a different color. If you find the outlines hard to see, turn off the **Countries** layer.

 Click the Identify tool .

 In the Identify Results window, select the **Ocean Basins** layer from the drop-down menu.

 Next, click within each ocean basin and read the name of the basin in the Identify Results window.

1. Label the five global ocean basins on Map 1 on the next page.

 Close the Identify Results window.

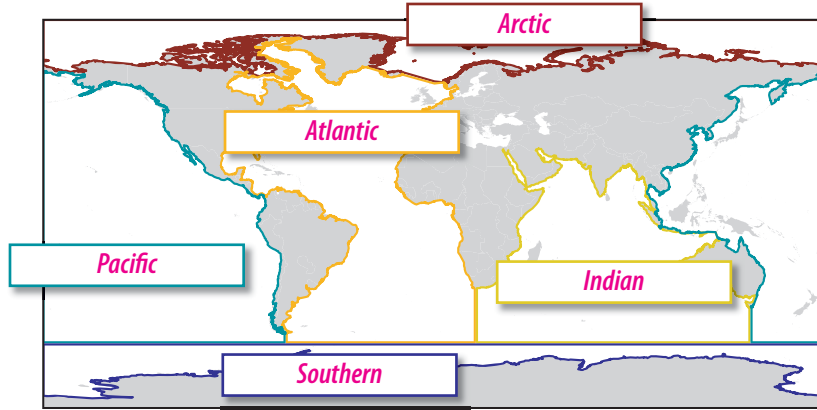
Mapping the ocean floor

Early depth measurements were often labor-intensive and prone to error (Figure 1 at left). Fortunately, today we can map the features of the ocean floor on a global scale using satellites. The satellites measure tiny variations in the height of the ocean surface caused by gravity, which correspond directly to the depth of the ocean floor.

Are there two Pacific Ocean basins?

No. Earth’s curved surface has to be “split” somewhere in order to make a flat map. Here, the split was made at 180° longitude, dividing the Pacific Ocean basin into two parts. One part appears on the far right and the other on the far left of the map.

Map 1 — Global ocean basins



Bathymetric profiles

One way to examine ocean depth data is by creating bathymetric profiles that show what the ocean floor would look like if you sliced through it and viewed it from the side. These profiles illustrate the shape of the basin and reveal submerged features. Next you will create increasingly detailed profiles to see how our understanding of the ocean basins has improved over the past 150 years.

Like early sailors and explorers, your first profile of the Atlantic Ocean Basin will be based on only a few depth measurements.

- Turn on the **Atlantic Crossing** layer.

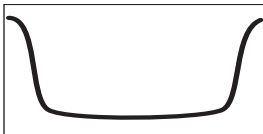
This layer displays the path of a ship crossing the Atlantic Ocean from Florida to Africa.

- Click the QuickLoad button .
- Select **Spatial Bookmarks**, choose **Atlantic Crossing**, and click **OK**.

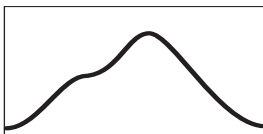
- On Graph 1, see the profile (an outline) of the ocean floor across the Atlantic Ocean basin will look like along the ship’s path from North America to Africa. (See sidebar for examples.)

Simple profiles

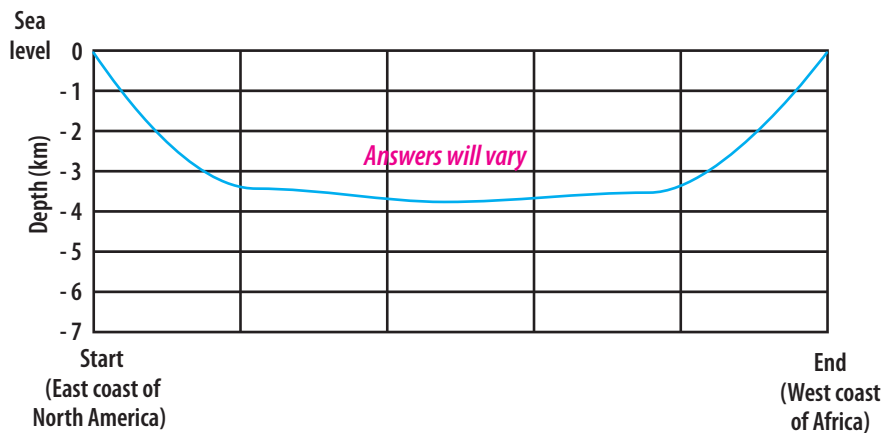
A profile through a bathtub would look something like this:



Whereas a profile of a mountain might look like this:







Graph 1 — Predicted depth profile of Atlantic Ocean Basin



- Explain your reasoning for the shape of the profile

-  Turn off the **Ocean Basins** layer.
-  Turn on the **Atlantic Bathymetry** layer.
-  Turn on the **Depth Measurements #1** layer.

The **Depth Measurements #1** layer displays four green points, labeled 1 through 4, at intervals along the ship’s path. Each point represents a location where the ship stopped to measure and record the ocean depth.

-  Click the Identify tool .
-  In the Identify results window, select the **Depth Measurements #1** layer from the drop-down menu.
-  Next, click on each of the four points along the path and read the depth at each point from the Identify Results window.

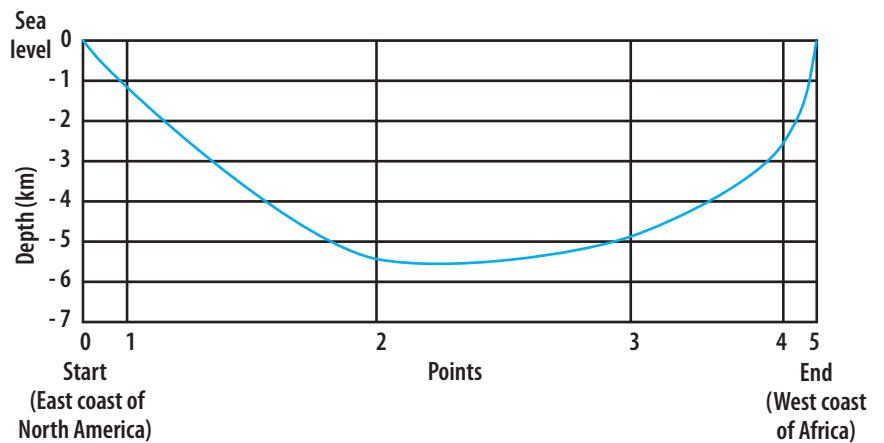
4. Record the depth values for each of the four points in Table 1. Round values to the nearest 0.1 km.

Table 1 — Atlantic Ocean Basin depth measurements #1

Point	Depth (km)
0	0
1	<input style="width: 50px; height: 20px;" type="text"/>
2	<input style="width: 50px; height: 20px;" type="text"/>
3	<input style="width: 50px; height: 20px;" type="text"/>
4	<input style="width: 50px; height: 20px;" type="text"/>
5	0

5. Plot the depth values from Table 1 on Graph 2. Draw a smooth line through each point beginning at point 0 (sea level) on the North American coast and ending at point 5 (sea level) on the African coast.

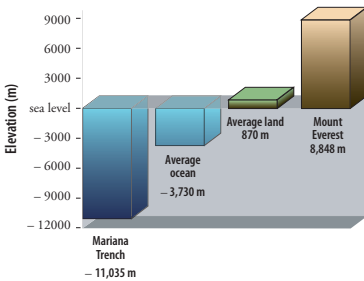
Graph 2 — Atlantic Ocean Basin depth profile 1



6. Describe the shape of the Atlantic Ocean basin as it appears in Graph 2. How does it differ from your predicted profile in Graph 1?

Why is the depth negative?

The elevation of a mountain like Mount Everest is based on measuring from sea level to the top of the mountain. In these materials, we will use negative values of elevation to express the depth of a body of water from sea level downward. Therefore, we will say the depth of the Mariana Trench is – 11,035 meters.



 Close the Identify Results window.


Next, you will create a bathymetric profile of the Atlantic Ocean using measurements taken at different points along the ship’s path.


 Turn off the **Depth Measurements #1** layer.

 Turn on the **Depth Measurements #2** layer.

This layer displays five blue points that represent the locations of the new depth measurements.

 Click the Identify tool .

 In the Identify results window, select the **Depth Measurements #2** layer from the drop-down menu.

 Next, click on each of the five points along the path and read the depth at each point from the Identify Results window.

- Record the depth values for each of the five points in Table 2. Round values to the nearest 0.1 km.

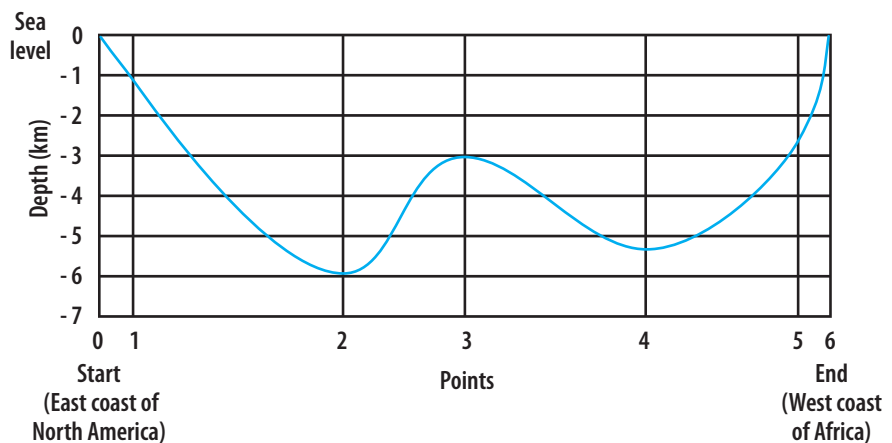
Table 2— Atlantic Ocean Basin depth measurements #2

Point	Depth (km)
0	0
1	<input type="text"/>
2	<input type="text"/>
3	<input type="text"/>
4	<input type="text"/>
5	<input type="text"/>
6	0

 Close the Identify Results window.

- Plot the depth values from Table 2 on Graph 3. Draw a smooth line through each point beginning at point 0 (sea level) on the Florida coast and ending at point 6 (sea level) on the African coast.

Graph 3— Atlantic Ocean Basin depth profile 2



9. Compare Graph 3 to Graph 2. Describe any “new” features that appeared in Graph 3 that are not visible in Graph 2.

10. How do the number and selection of measurement locations affect the profile?

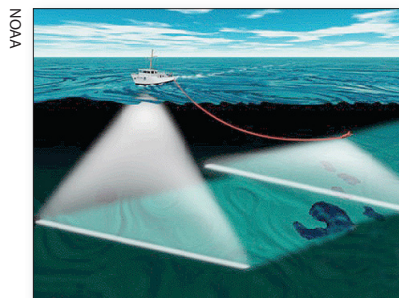



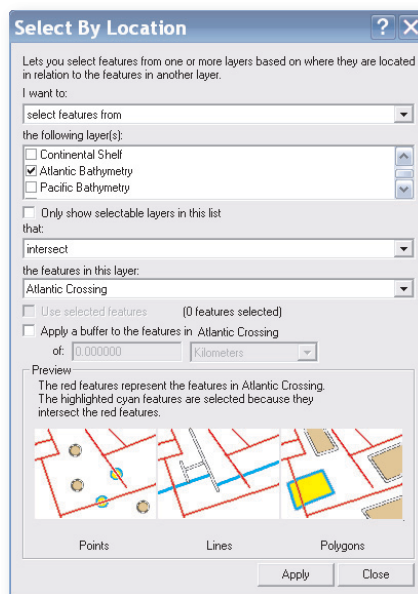


Figure 2. Sonar measures the depth of the water by determining the time it takes sound waves to travel to the ocean floor and back.

-  Turn off the **Depth Measurements #2** layer.
-  Turn off the **Atlantic Crossing** layer.









In the last two profiles you created, you used depth measurements taken at only a few locations. Next, you will create a bathymetric profile of the Atlantic Ocean basin along the ship’s path using nearly continuous depth measurements like those generated by sonar (Figure 2).

-  Click the **Select By Location** button .
-  In the **Select By Location** window, construct the query statement:
I want to **select features from** the **Atlantic Bathymetry** layer that **intersect** the features in the **Atlantic Crossing** layer.



-  Click **Apply**.
-  Close the **Select By Location** window.





Sixty bathymetry measurements along the **Atlantic Crossing** path should be highlighted. Next, you will construct a graph using these depth measurements.

-  Select the **Atlantic Bathymetry** layer.
-  Click the Open Attribute Table button  to open the **Atlantic Bathymetry** attribute table. (Warning: Do not click anywhere in the table window, or you will lose the features you selected in the previous step.)
-  Click **Options** and choose **Create Graph**.
-  Under Graph type, click **Column**. Do not alter the Graph subtype. Click **Next**.
-  In the next window, select the **Atlantic Bathymetry** layer and the **Depth (km)** field. Be sure to check the box to use the selected set of features or records. Click **Next**.
-  In the next window, click **Finish**.
-  Close the **Atlantic Bathymetry** Attribute Table to view the graph.

The graph now displays depth measurements along the ship's path across the Atlantic Ocean, creating a bathymetric profile.

11. Using this graph, describe the features that characterize the floor of the Atlantic Ocean basin. (Hint: Click and drag on the corner of your graph to enlarge it. This will help you see the ocean floor in more detail.)

12. How did increasing the number of depth measurements change your view of the ocean floor bathymetry in the Atlantic Ocean basin?

-  Close the graph window.
-  Click the Full Extent button  to view the entire map.
-  Quit ArcMap and do not save changes.