



## Learning Ocean Science through Ocean Exploration

### Section 1

# Ocean Exploration

## Ocean Exploration

Ocean exploration has been a human endeavor for as long as humans have designed boats and been able to put to sea. Ocean exploration is not the province of any single culture. Polynesians, Phoenicians, Norsemen—all were fabulous sailors and explorers. Humans managed to reach islands and continents isolated by oceans—sometimes by relatively shorter island hops as in the population of Australia, sometimes by sailing into the unknown across whole oceans to reach distant places like the Hawaiian Islands. In the process they invented technologies that enabled them to explore more effectively and safely—better vessels and navigation systems based on the position of the sun and stars.

Humans are by nature record keepers and collectors of information and materials because knowledge enhances survival. If the explorers returned home, they brought new knowledge as well as materials such as metals, plants and animals. Much of that new information would be called science today.

Most United States students take American history. Hence, their knowledge of ocean exploration may be focused on the discovery and exploration of the New World by Europeans. Portuguese, Spanish, and English explorers from the second half of the last millennium are most familiar to them. These explorers kept journals and records that we still read today. They took artists and natural historians with them to document what they found. For example, Vancouver explored the west coast of

### **Challenger Expedition of 1874**

the United States with a science illustrator. Sir Walter Raleigh employed John White to draw species from the Chesapeake and Virginia area. Mark Catesby was sent from England in 1724 to explore the East coast of the colonies for Sir Hans Sloan in England. He water colored over 220 plates and sent back countless specimens during his four-year collecting journey. During the Lewis and Clark Expedition, Meriwether Lewis recorded his discoveries through his own scientific illustrations. The work of these men and their artists remains interesting today. They were the first explorers to chart and draw the natural history of what is now the United States.

Modern ocean science exploration started with the *Challenger* Expedition of 1874—the first focused ocean science expedition. It was much longer than modern expeditions and very expensive. Victorian Great Britain had a fascination with science and scientific discovery that is reflected in their public funding of and interest in natural history museums. The United States' own Smithsonian Institution was funded by an Englishman and named for him. The *Challenger* Expedition was funded by the British government. Its explorers were charged with studying and mapping the oceans of the world. This four-year research expedition produced 50 volumes of scientific writing and illustrations over a 10-year period. Its specimen collections are still archived and studied, its publications still referenced and read.

Technological innovations since the *Challenger* have constantly improved the quality and quantity of scientific information produced by ocean explorers. Victorians' views of ocean creatures were limited to drawings and specimens in jars. Where once water samples were collected in bottles and weather was recorded from instruments by hand, oceanographers now have satellite data and remote sensing from ocean drifting or fixed equipment arrays, and these same data appear on the evening news. The lead line that measured how deep

the water has been replaced by sonar that is available to recreational boaters. Today we see fabulous video footage of underwater discoveries on television, as IMAX films and in print media. Where Victorians read journals published upon the return of an expedition, we can now follow scientists along in real time on the expedition over the Internet, seeing what they see, discovering what they find. And yet our ocean remains less explored than the backside of the moon. Amazing new discoveries are still waiting to be made.

The National Oceanic and Atmospheric Administration's creation of the Office of Ocean Exploration (OE) launched a new era of ocean exploration. NOAA recognizes that there are many exciting discoveries waiting to be made. Ocean explorers are taking us along with them through the Ocean Explorer (OE) web site and the associated CD. This is your chance to share the excitement of ocean science discoveries with your students.

This section includes:

- *Calling All Explorers* from Deep East 2001.

Additional exercises related to ocean explorers and the theme of exploration are found on the OE web site or OE CD. They are:

- *Why Do We Explore?* from Deep East 2001 and Galapagos Rift in 2002
- *Journey to the Unknown* also found on Deep East 2001 and Galapagos Rift in 2002

**Classroom Activities about  
Ocean Exploration  
in this Section**

**Where to Find  
More Activities on  
Ocean Exploration**

## Lesson Plan 1

# Calling All Explorers

### FOCUS

The history of ocean exploration with emphasis on recent explorers of deep-sea environments

### FOCUS QUESTION

Who are some past and present ocean explorers and what are their accomplishments?

### LEARNING OBJECTIVES

Students will research and write about what it means to be an ocean explorer, both modern and historic.

Students will describe the nature of oceans and ocean exploration.

Students will meet science mentors and role models on-line.

### ADDITIONAL INFORMATION FOR TEACHERS OF DEAF STUDENTS

The words listed as Key Words should be introduced prior to the activity. This activity allows the students to do their own research but in the process they will likely encounter many words unfamiliar to them. It might be helpful to review the student handout with the students prior to sending them to explore the Web site.

Students may need some assistance with the questions that ask for their own opinion or ideas. Prior to the individual exploration activity, it would be helpful for teachers to discuss role models in general and then share a story of their own role model(s) in science.

### MATERIALS

- Web Quest NOAA Site: [oceanexplorer.noaa.gov/explorations/deepeat01/deepeat01.html](http://oceanexplorer.noaa.gov/explorations/deepeat01/deepeat01.html) on-line or an OE CD

For each student:

- Part I: Team Exploration – *Cooperative Explorers Web Quest Data Sheet*
- Part II: Individual Exploration – *Individual Explorers Reflection Sheet*

### AUDIO/VISUAL MATERIALS

Internet connection for student use

### TEACHING TIME

Two 45 minute periods, one each for two parts

### SEATING ARRANGEMENT

Part I: Groups that work with your computer arrangement

Part II: Individual work in a place that lends itself to reflection

### KEY WORDS

Exploration  
Documentation  
Science role models  
Biodiversity  
Extreme environments

### BACKGROUND INFORMATION

The National Oceanic and Atmospheric Administration's Office of Ocean Exploration launched a new era of ocean exploration. Its creation recognizes that there are many exciting discoveries waiting to

be made. Ocean explorers are taking us along with them through the OE web site and the associated CD. This exercise introduces your students to the OE web site (or CD) and to the people who are the modern ocean explorers. It is designed to enable them to move at their own pace, in self-directed exploration of the OE site.

## LEARNING PROCEDURE

### Part I: Team Exploration

1. Assign students to computers in small groups with one *Cooperative Explorers Web Quest Data Sheet* per student and let them work through the sheet as a group.

### Part II: Individual Exploration

1. Provide copies of *Individual Explorers Reflections Sheet*. This individual work may be assigned as homework rather than done in class. Be sure to have a class discussion after the work is turned in to get your student's reactions to modern vs. historic explorers.

## THE BRIDGE CONNECTION

[www.vims.edu/bridge](http://www.vims.edu/bridge)

## THE "ME" CONNECTION

All of Part II: Individual Exploration is the "Me" Connection

## CONNECTION TO OTHER SUBJECTS

English/Language Arts, Physical Earth, Life Sciences, Art/Design

## EVALUATION

Use Student Evaluation Sheets. See *Teacher Key, Part I and Part II*

## EXTENSIONS

Ask students to investigate career opportunities as ocean explorers, ocean scientists, and others whose careers support ocean science and exploration.

Visit the Ocean Exploration Web Site at:

[oceanexplorer.noaa.gov](http://oceanexplorer.noaa.gov)

## RESOURCES

[oceanexplorer.noaa.gov/library/readings/welcome.html](http://oceanexplorer.noaa.gov/library/readings/welcome.html)

Readings illustrating the history, science, and personal stories of those involved in ocean exploration

[oceanexplorer.noaa.gov/history/history.html](http://oceanexplorer.noaa.gov/history/history.html)

A comprehensive look at NOAA's 200 year history of ocean exploration

## NATIONAL SCIENCE EDUCATION STANDARDS

### Content Standard G – History & Nature of Science

- Science as a human endeavor
- The nature of science

*Activity developed by Kimberly Williams, Miller Place High School, Long Island, New York*

*Additional information for teachers of deaf students developed by Denise Monte, Teacher of the Deaf and Audiologist, American School for the Deaf, West Hartford, Connecticut*

## Student Handout

### Part I: Cooperative Explorers Web Quest Data Sheet

Welcome, Ocean Explorers! Please proceed to the following web site:  
[oceanexplorer.noaa.gov/explorations/deepeast01/deepeast01.html](http://oceanexplorer.noaa.gov/explorations/deepeast01/deepeast01.html)  
or use the Ocean Exploration CD to find Deep East ocean explorers

Your first mission is to find the link to the deep-sea explorers.

- 1) Write that link here: \_\_\_\_\_
  
- 2) List three places in the deep sea where ocean explorers have done their recent research:
  - a) \_\_\_\_\_
  
  - b) \_\_\_\_\_
  
  - c) \_\_\_\_\_
  
- 3) There are many individuals studying the deep sea. List at least five here and describe their field of research.
  - a) \_\_\_\_\_
  
  - b) \_\_\_\_\_
  
  - c) \_\_\_\_\_
  
  - d) \_\_\_\_\_
  
  - e) \_\_\_\_\_
  
- 4) Describe what your day might be like if you were a marine chemist:  
If I were a marine chemist, I would. . . .  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Student Handout**

5) In some ways, deep-sea explorers of modern times are similar to historic explorers. They are brave, curious people who are at the cutting edge of their field of interest. They are very unique individuals. One major difference is that women are an important part of ocean science research in modern times. For example, one of the scientists shown in your Web Quest is the only woman certified to pilot the deep sea submersible known as the *Alvin*. Find her name and describe what type of science she does?

Dr. \_\_\_\_\_ studies \_\_\_\_\_.

6) Often our first inspiration to be curious and to explore comes from our parents and our teachers. Which explorer's elementary teacher inspired him by having him read *A Half Mile Down*, by William Beebe, a book about the first deep dive? Have you read this book?

Dr. \_\_\_\_\_

Bonus: List other explorers who were inspired by parents and/or teachers?

Dr. \_\_\_\_\_

Dr. \_\_\_\_\_

Dr. \_\_\_\_\_

7) How do you think that exploring the deep sea is similar to exploring outer space? Different?

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8) Which scientist explorer studies biodiversity and believes that extreme environments (such as those in the deep sea) may give us insight into life on other planets?

Dr. \_\_\_\_\_

## Student Handout

9) There is a big world waiting for you to explore it, and the technology to do so gets better every day. Yesterday's discoveries are today's necessities. Which explorer hopes that new compounds from the deep sea will be used in the future to treat diseases?

Dr. \_\_\_\_\_

10) As we learn more about the vastness of the planet we inhabit, we realize how little we know about the creatures and plants with which we share it. Which scientist studies the relationship between food supply and egg production in deep water invertebrates?

Dr. \_\_\_\_\_

11) Another group of creatures that shares the Earth with us are beautiful single-celled, shelled protozoans. Name these creatures and the explorer who studies them:

The creatures are known as \_\_\_\_\_

They are studied by Dr. \_\_\_\_\_

12) On the back of this data sheet, document your time of exploration on the Deep Sea Explorer Web Quest by drawing something that represents your favorite part of the site. Label your drawing and tell why this part of the site was interesting to you.

Congratulations, Explorers!  
You have successfully navigated the Deep Sea Explorer Web Quest!



## Teacher Answer Key

### Part I Cooperative Explorers Web Quest Data Sheet

The answers are specific to the Deep East 2001 expedition. If the students used the entire OE web site or CD, many more answers are possible!

1) Write that link here:

[oceanexplorer.noaa.gov/explorations/deepeast01/background/explorers/explorers.html](http://oceanexplorer.noaa.gov/explorations/deepeast01/background/explorers/explorers.html)

2) List three places in the deep sea where science explorers have done their recent research:

a) George's Bank Canyon

b) Hudson River Canyon

c) Blake Ridge

3) There are many individuals studying the deep sea. List at least five here and describe their field of research.

Answers may vary, some answers include:

Dr. Les Watling, Dr. Scott C. France, Mr. Andrew Shepard

Dr. Peter Auster, Ms. Caren Menard, Dr. Mary Scranton

Dr. Kevin Eckelbarger, Mr. Karl Stanford, Dr. Peter Rona

Dr. Barbara Hecker, Dr. Fred Grassle, Dr. Ellen K. Pikitch

Ms. Diana Payne, Dr. Michael Bothner

Ms. Holly Donovan, Ms. Tanya Podchaski, Ms. Rebecca Cerroni

Dr. Michael DeLuca, Dr. Cindy Lee Van Dover, Dr. Joan Bernhard

Dr. Carolyn Ruppel, Dr. Barun Sen Gupta, Ms. Paula Keener-Chavis

4) Describe what your day might be like if you were a marine chemist: If I were a marine chemist, I would. . . .

Answers will vary-students will probably take information from the interviews of the marine chemists listed above for the descriptions of their imaginary day as a marine chemist.

5) In some ways, deep-sea explorers of modern times are similar to historic explorers. They are brave, curious people who are at the cutting edge of their field of interest. They are very unique individuals. One major difference is that women are an important part of ocean science research in modern times. For example, one of the scientists shown in your Web Quest is the only woman certified to pilot the deep sea submersible known as the *Alvin*. Find her name and describe what type of science she does?

Dr. Cindy Lee Van Dover studies Marine Chemistry

6) Often our first inspiration to be curious and to explore comes from our parents and our teachers. Which explorer's elementary teacher inspired him by making him read *A Half Mile Down*, by William Beebe, a book about the first deep dive? Have you read this book?

Dr. Peter Rona I have/have not read *A Half Mile Down*

## Teacher Answer Key

Bonus: List other explorers who were inspired by parents and/or teachers. Some are:

Dr. Fred Grassle

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Dr. Mary Scranton

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Dr. Joan Bernhard

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7) How do you think that exploring the deep sea is similar to exploring outer space? Answers will vary. Some include:

Humans would need special equipment to survive and explore there.

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Humans know very little about both places.

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Humans get very excited about the prospect of finding life in both places.

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8) Which explorer studies biodiversity and believes that extreme environments (such as those in the deep sea) may give us insight into life on other planets?

Dr. Joan Bernhard

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9) There is a big world waiting for you to explore it, and the technology to do so gets better every day. Yesterday's discoveries are today's necessities. Which explorer hopes that new compounds from the deep sea will be used in the future to treat diseases?

Dr. Fred Grassle

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10) As we learn more about the vastness of the planet we inhabit, we realize how little we know about the creatures and plants that share it with us. Which scientist studies the relationship between food supply and egg production in deep-water invertebrates?

Dr. Kevin Eckelbarger

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11) Another group of creatures that shares the Earth with us are beautiful single celled, shelled protozoans. Name these creatures and the explorer who studies them.

The creatures are known as Foraminifera.

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They are studied by Dr. Barun Sen Gupta.

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12) On the back of this data sheet, document your time of exploration on the Deep Sea Explorer Web Quest by drawing something that represents your favorite part of the site. Label your drawing and tell why this part of the site was interesting to you.

Enjoy your students' drawings and celebrate the diversity of their interests.

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Congratulations, Explorers!  
You have successfully navigated the Deep Sea Explorer Web Quest!

## Student Handout

### Part II: Individual Explorers Reflections Sheet

- 1) Reflect and write about differences and similarities between explorers of the past and modern day explorers. What types of hardships do both have in common?

Some Similarities:

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Some Differences:

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- 2) Name some places that have been explored in modern times.

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- 3) Name places that were explored during the early history of humans.

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- 4) Describe a place that you have explored. What was unique about it that you think another visitor to that site would not have noticed?

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- 5) Name and describe a place that you would like to explore. What do you think you would find there? Why?

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