

WELCOME TO THE SEA FLOOR EXPLORER SERIES PROGRAMS

These programs link middle school and high school students directly to current research in oceanography and provide opportunities to use authentic research procedures and equipment. The series challenges students to design instrumentation, collect data, and communicate results while using the interactive, site-wide, NSF-funded Sea Floor Science Exhibition.

Now entering its third year, the Sea Floor Explorer Series has been a tremendous success and has led to the awarding of a major grant from the National Science Foundation (NSF). As a result, our partnerships with leading research institutions are growing even stronger, and our campus will be transformed this year as our Sea Floor Science Exhibition continues to come to life.

Our Sea Floor Science partner institutions include Jet Propulsion Laboratory (NASA/Caltech), Scripps Institution of Oceanography, Texas A & M University/Institute of Nautical Archaeology, and MIT's DeepArch Research Group. These institutions have collaborated with the Ocean Institute to develop investigations that meet content standards in earth, life, and physical sciences.

Please take a few moments to familiarize yourself with the materials we have included, and share them with other teachers and chaperones that will be joining you. These materials contain important information to prepare you, your chaperones, and your students for your visit. You will also find important forms that must be returned to the Ocean Institute in order for you and your students to participate.

If you have any questions about your visit to the Ocean Institute, please do not hesitate to contact our Ocean Education Center Coordinator, Tracy Kirby at 949-496-2274, extension 213. Again, welcome to the Sea Floor Explorer series of programs! We are looking forward to your visit.

Sincerely,
Rick Baker
Senior Program Director, Science



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APPENDIX – FORMS

- Acknowledgement of Risk and Waiver
- R/V Sea Explorer* Manifest
- Special Information Form



A. ADMINISTRATIVE CHECKLIST FOR THE PROGRAM

Immediately upon receiving this package...

- Carefully review the Teacher Preparation Package
- Arrange your transportation

Two months prior to your trip...

- Arrange for parent chaperones—please limit the number to two adults for every 12 students
- Confirm student and adult numbers with the Ocean Institute

One month prior to your trip...

- Begin student preparation
- Copy and distribute Acknowledgement of Risk and Waiver to each student and adult
- Contact the Ocean Institute with any changes in student numbers
- Return the Special Information Form to the OEC Coordinator**

Two weeks prior to your trip...

- Mail program payment to the Ocean Institute—full payment must be received a minimum of 10 days before your program
- Collect Acknowledgement of Risk and Waiver from each student
- Contact parents to remind them to sign and return the Acknowledgement of Risk and Waiver

Note: We cannot guarantee that changes in numbers of students or adults can be accommodated if requested within two weeks of your program date

One week prior to your trip...

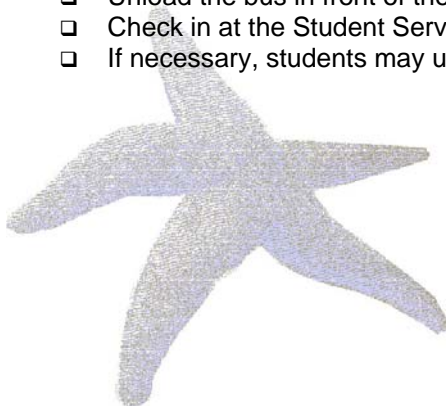
- Review behavioral expectations with students
- Contact the Ocean Institute with any last minute questions or changes

24 hours to go!!!...

- If inclement weather is expected, contact the Ocean Institute for status of the program
- Prepare nametags for students and adults

When you arrive for the Sea Floor Explorer Program...

- Unload the bus in front of the Ocean Institute
- Check in at the Student Services building with a final head count
- If necessary, students may use the restroom facilities—please limit use to 7 girls and 7 boys at a time



B. DESCRIPTION OF THE PROGRAM

Laboratory Stations:

Coring/ Foraminifera: *Students will study several key concepts:* Cores can help tell the story of Plate Tectonics. Scientists can look at how the Earth has moved and changed over time by the various sediments in the layers that suggest tectonic activity. New sea floor is created in the process of sea floor spreading. Microfossils are *biogenous sediment* consisting of skeletons and shells of marine organisms and are analyzed in cores to help analyze past climate changes.

A core is a long pipe-shaped plug extracted from the seafloor by oceanographers using various devices. Deep-sea sediments contain microscopic fossils of marine plants and animals, volcanic glass and minerals, cosmic material and other unusual materials unique to a marine environment such as marine snow and manganese nodules. Cores reveal Earth's ancient climate. Cores can tell a story about a climate by using microfossils that are in the layers of sediment. The microfossils (foraminifera, radiolarian, diatoms, etc.) are important time and environmental indicators.

Remote Operated Vehicles: Students will understand concepts of pressure and buoyancy as they learn how technology is playing a major role in understanding how our planet works. Students will drive an ROV to explore the bottom of the submergence tank with the added challenge of retrieving a sand sample, or an object from the bottom.

A Remotely Operated Vehicle (ROV) is essentially an underwater robot that allows the vehicle's operator to remain in a comfortable environment while the ROV works in the hazardous environment below. ROVs are now used in many different fields of ocean science as well as commercial uses.

Sea Floor Spreading/ Barstow:

Barstow --Students will learn about the San Andreas fault formed by the sliding of the Pacific Plate past the North American plate and develop concepts as to how these changes affect our lives here in Southern California. As these two plates continue to move, the Sea of Cortez is extending its boundaries northward at a rate of about 2 inches per year. Students will calculate how long it will take to reach a specific location in Southern California. Students should come away with a feeling for how much time is involved with geologic processes and the knowledge that the Sea of Cortez is a relatively new sea formed by movement of the San Andreas fault, and it continues to grow.

Sea Floor Spreading – Students will understand several basic concepts; The Mid-Atlantic ridge is part of a divergent or spreading boundary; The earth has a magnetic field; the poles are not stable and move; polar reversals help support the theory of plate tectonics. The Earth's magnetic poles have flip-flopped several times throughout geologic history and scientists have studied this phenomenon through the iron molecules orientated to magnetic north within the basalt rock found on the sea floor. Each time there is an eruption in the spreading center a new layer of basalt is deposited, resulting in a magnetic 'fingerprint' that represents the direction of the present-day magnetic poles. Polar reversal events average once every 500,000 years, however, once the shift begins, it takes approximately 1,000-5,000 years to complete the process!

Seismometer Activity/ Globe Display – Students will understand how we have been able to map the sea floor and how we can begin to detect and understand the processes of earthquakes. Students will be introduced to a seismometer and oscilloscope and learn how they work. SONAR is also introduced, and students will explore its role in the mapping of the sea floor. At our interactive globe display, students review quickly the basics of plate tectonics and how earthquakes and volcanoes are associated with those boundaries. If time permits, students can also see images of Mars and Europa and learn how studying plate tectonics here on Earth is helping us learn more about geology in outer space.

R/V Sea Explorer Stations:

Core sample/ Foram panning: After a core sample is taken in the harbor, students will sieve the mud from the core for foraminiferas. If forams are isolated, they will be taken inside to the microscope station and identified. Students will also retrieve a live plankton sample and under the microscopes see if they can identify any live forams or radiolarians in the sample!

The second station for cores is at the mud station. Students will examine the mud of the core, analyze layers, discuss sedimentation rates and look for different deposits. Students will also compare two different types of mud from different locations of the ocean and harbor.

ROV/SONAR: Students will all get an opportunity to drive an ROV off the stern of the ship in the harbor. Students will also discuss pressure, and see the effects of pressure on Styrofoam heads that have been lowered to extreme depths. Students will also discuss the use of sonar and see live images of side scan sonar being produced by the device under the boat. Students will try to locate the ROV underwater with the sonar image and direct the ROV crew to a particular object or point.



C. LINKS TO CALIFORNIA SCIENCE STANDARDS

Grade Six

Plate Tectonics and Earth's Structure

- 1.a. Students know evidence of plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and midocean ridges; the distribution of fossils, rock types, and ancient climate zones.
- 1.b. Students know Earth is composed of several layers: a cold, brittle lithosphere; a hot, convecting mantle; and a dense, metallic core.
- 1.c. Students know lithospheric plates the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.
- 1.d. Students know that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.
- 1.e. Students know major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.

Shaping Earth's Surface

- 2.d. Students know earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

Investigation and Experimentation

- 7.a. Students will develop a hypothesis.
- 7.b. Students will select and use appropriate tools and technology to perform tests, collect data, and display data.
- 7.f. Students will read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a simple scale map.
- 7.g. Students will interpret events by sequence and time from natural phenomena (e.g., the relative ages of rocks and intrusions).

Grade Seven

Earth and Life History (Earth Science)

- 4.a. Students know Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.
- 4.b. Students know the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impact of asteroids.
- 4.c. Students know that the rock cycle includes the formation of new sediment and rocks and that rocks are often formed in layers, with the oldest generally on the bottom.
- 4.e. Students know fossils provide evidence of how life and environmental conditions have changed.
- 4.f. Students know how movements of Earth's continental and oceanic plates through time, with associated changes in climate and geographic connections, have affected the past and present distribution of organisms.

Investigation and Experimentation

- 7.a. Students will select and use appropriate tools and technology to perform tests, collect data, and display data.

Grade Eight

Motion

- 1.c. Students know how to solve problems involving distance, time, and average speed.
- 1.d. Students know the velocity of an object must be described by specifying both the direction and the speed of the object.

Forces

- 2.a. Students know a force has both direction and magnitude.
- 2.e. Students know that when the forces on an object are unbalanced, the object will change its velocity (this is, it will speed up, slow down, or change direction).

Density and Buoyancy

- 8.c. Students know the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced.
- 8.d. Students know how to predict whether an object will float or sink.

Grades Nine through Twelve

Physics

5.f. Students know magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other charges.

Earth Sciences

- 1.c. Students know the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from earth today.
- 3.a. Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.
- 3.b. Students know the principal structures that form at the three different kinds of plate boundaries.
- 3.c. Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.
- 3.d. Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.
- 6.c. Students know how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.
- 9.b. Students know the principal natural hazards in different California regions and the geologic basis of those hazards.

Investigation and Experimentation

- 1.a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- 1.d. Formulate explanations by using logic and evidence.
- 1.f. Distinguish between hypothesis and theory as scientific terms.
- 1.h. Read and interpret topographic and geologic maps.
- 1.i. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.



D. ADMINISTRATIVE PREPARATION FOR THE DAY PROGRAM

ADMINISTRATIVE CONTACT

For questions regarding the **Sea Floor Explorer Programs**, please contact:

Tracy Kirby, Ocean Education Center Coordinator
Telephone Number: (949) 496-2274, extension 213
E-mail: tkirby@ocean-institute.org

INTRODUCTION

Thank you for choosing the Ocean Institute as your field trip destination. We appreciate the time and effort it takes to prepare your students for their program, and we will do everything we can to make their experience as rewarding as possible.

Please make sure that all of the participating teachers have a copy of these teacher materials. The information contained here can help you find answers to your questions, develop your preparation timeline, and prepare both your students and chaperones. This packet also contains directions to the Ocean Institute as well as contact telephone numbers—please call us at any time with questions you may have about your field trip.

TEACHER INFORMATION: BEFORE YOUR PROGRAM

You can do several things before you arrive to help make your program run as smoothly as possible:

- **Complete and return the Program Information Form** to the OEC Coordinator. Notify the Ocean Institute staff of students with special health or behavioral considerations. **We must have the accurate number of students attending the program at least one month before your program in order to ensure proper staffing and equipment.**
- Review the program goals, station activities, and expected behaviors with the students before you arrive. Complete the classroom activity with your students, and make sure they have a clear understanding of the educational concepts they will explore during the program.
- Spend some time choosing and preparing your parent chaperones. Review the program goals, station activities, and expected student behaviors with them before you arrive. Make sure that they have a clear understanding of their role as a chaperone.
- Send program payment to the Ocean Institute at least 10 days before the scheduled date of your field trip.
- Have a signed Acknowledgement of Risk and Waiver for each participant before boarding the bus.
- Accurately complete the *R/V Sea Explorer* manifest before boarding the bus, noting the correct number of students and adults, and double-checking each name on the manifest.

TEACHER INFORMATION: DURING YOUR PROGRAM

Ocean Institute instructors are all well trained to instruct students of different ages and abilities. You and the chaperones can help the instructors monitor student behavior and safety. There are several things you can do to facilitate the smooth running of your educational program:

- Work cooperatively with Ocean Institute instructors and parent chaperones to manage students during the program.
- Work cooperatively with Ocean Institute instructors and parent chaperones to solve student and chaperone management problems.
- Report any problems to the Ocean Institute staff as soon as possible.

CHAPERONE INTRODUCTION AND INFORMATION

Adult chaperones play a significant role in safety and the educational quality of the program. We request that you bring no more than 2 adults per 12 students. We ask your chaperones to help us in the following ways:

- Work cooperatively with Ocean Institute instructors and classroom teacher to enforce all safety rules
- Work cooperatively with Ocean Institute instructors and classroom teacher to keep students on task at the stations
- Guide students to different stations throughout the program
- Act as a positive role-model for the students by exhibiting enthusiasm for learning without answering questions directed at students

PAYMENT

Payment must be received 10 days before your program date. Please mail a **single check** for the total amount of the program minus the deposit you have already paid. Please make the check payable to **Ocean Institute**.

FINAL COUNT

Call the Ocean Institute two days before your program if the number of students or adults changes. When you arrive at the Ocean Institute for your program, you must have an accurate count of total students and adults participating in the program. If the number of participants listed on your Program Agreement is not accurate, call the Ocean Institute immediately. **We cannot guarantee that changes in numbers of students or adults can be accommodated if requested within 2 weeks of your program date.**

STUDENT AID

The Ocean Institute maintains a student aid fund for students who are unable to obtain sufficient funding to attend the program. Please call (949) 496-2274, extension 0 for more information and to receive the necessary forms for student aid.

TRANSPORTATION

Student transportation should be arranged well in advance. It is important that you arrive on time. Please schedule yourself to arrive 15 minutes before your scheduled program start time. If you arrive late, your program time will be shortened.

Buses can unload in front of the Student Services building. After the students have unloaded, the drivers will be notified of where to park the buses.

FORMS

The following forms can be found in the Appendix. Please make sure to have all the completed forms with you when you for your program.

Acknowledgement of Risk and Waiver

Each student must have this form signed by a parent or guardian to participate in any of the Sea Floor Explorer Series programs. Please make sure that you have one signed form for each student and adult chaperone when you check in with Student Services.

R/V Sea Explorer Manifest

Make sure each student and adult is accurately listed on the manifest.

Program Information Form

The program information form should be completed and mailed to the Ocean Institute at least one month prior to your program. Use this form to request your missions and inform us of any special needs. This information will help us prepare for your program.

STUDENT PREPARATION

The more familiar the students are with program concepts and content before they arrive, the more they will benefit from and enjoy their experience. We have included background information and a classroom activity to introduce important concepts to your students before they arrive for their program.

STUDENT BEHAVIORAL EXPECTATIONS

Please take time to discuss the academic nature of their field experience with your students before arriving at the Ocean Institute. When at the Ocean Institute, we expect your students to follow the same behavioral rules you have in your classroom.

STUDENT SAFETY RULES

The students will use tools and equipment during the Sea Floor Explorer Day Program. They must wear proper safety gear and follow the instructor's safety guidelines.

STUDENT CLOTHING AND SUPPLY LIST

For safety reasons, students participating in the program must have and/or wear the following clothing.

- Jacket
- Rubber-soled closed-toe shoes
- Hat
- Sunscreen

Optional Items:

- Camera with film
- Money for the gift and book store

CHAMBERS GIFT AND BOOK STORE

The Chambers Gallery Gift and Book Store is a non-profit museum store open daily from 9:00 AM to 5:00 PM. The revenue is directed toward lowering tuition for schools that participate in Ocean Institute programs. You and your class are encouraged to visit the store. To help accommodate all of the schools that plan to shop each day, please have one teacher check in with a store staff member before your students begin shopping.

There will be a limit on the number of students allowed to shop at one time as well as a three-minute time limit for each student. This is to ensure that all of your students will have time to shop. Please have two or three chaperones in the store to help supervise your students. One chaperone should stand at the door to monitor the students waiting in line. The other two adults should supervise the shoppers and remind them that they must make their selections quickly. Please ask the students to leave food, drinks, and backpacks outside with a friend while they are shopping, and remind them that sales tax will be added to their items.

DIRECTIONS TO THE OCEAN INSTITUTE

The address of Ocean Institute:
24200 Dana Point Harbor Drive
Dana Point, CA 92629
(949) 496-2274

Directions from Los Angeles:

- Travel south on Interstate 5
- Exit on the Pacific Coast Highway Exit
- Stay in the right lane of the exit ramp and go north on P.C.H.
- Turn left onto Dana Point Harbor Drive
- The road ends in the Ocean Institute parking lot

Directions from San Diego:

- Travel north on Interstate 5
- Exit on the Beach Cities Exit
- Stay in the left lane of the ramp and go north on P.C.H.
- Turn left onto Dana Point Harbor Drive
- The road ends in the Ocean Institute parking lot



E. CLASSROOM ACTIVITY

Introduce your students to vocabulary and background information before participating in the Ocean Institute field trip. Divide the class into three research teams to investigate and answer the following questions. You may wish to assign students to present their findings and information to the class, or come up with activities to illustrate these concepts.

CORING

1. Why are scientists interested in studying cores from the sea floor?
2. Why do cores have layers?
3. What are foraminifera? What can they tell us about the Earth?
4. List one type of sediment you may find on the sea floor near a tectonically active area.

ROVS

1. What does ROV stand for?
2. What are some jobs ROVs can do for scientists in the field?
3. What is the average depth of the ocean? How deep can humans go on just scuba?

UNDERWATER SEISMOLOGY/PLATE TECTONICS

1. List three geologic features found on the sea floor of the Pacific Ocean.
2. Why would a scientist be interested in looking at an underwater spreading center?
3. What plate boundaries affect California?
4. What does a seismometer do?
5. How does SONAR work?

