

multi-age format  
**WONDERS of CREATION**

THE NEW

AN  
OCC  
BOOK

FRANK SHERWIN

First printing: May 2004  
Revised and Updated  
Fourth Printing: January 2017

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Master Books® is a division of the New Leaf Publishing Group, Inc.

ISBN: 978-0-89051-905-9  
Library of Congress Number: 2003116033

Cover and Interior Design by Diana Bogardus

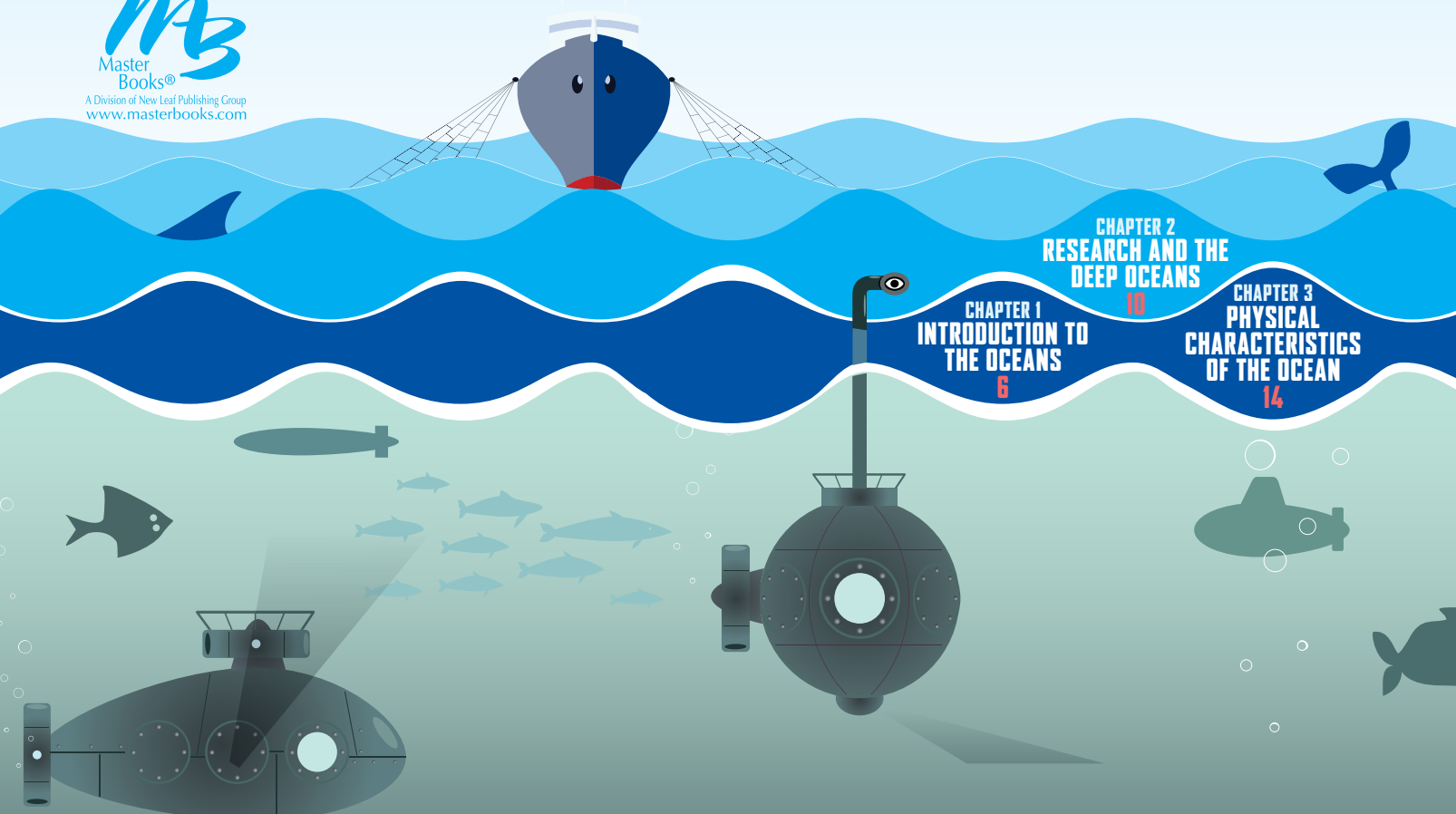
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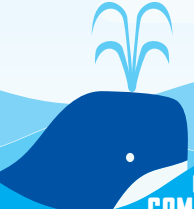
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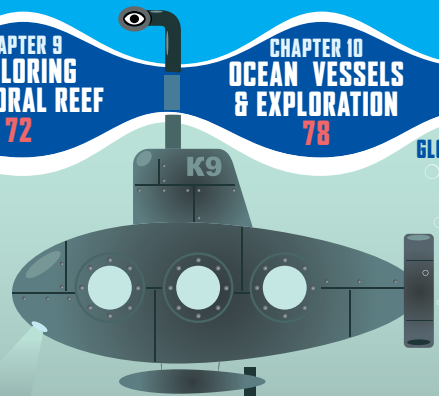
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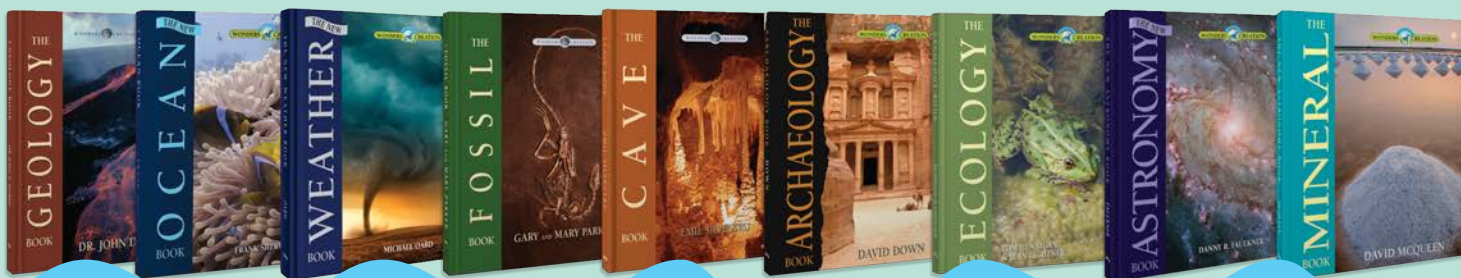
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multi-age format

## WONDERS *of* CREATION

**Our best-selling Wonders of Creation series keeps getting better!** The primary books in the series are being developed with an enhanced educational format and integrated with a unique color-coded, multi-skill level design to allow ease of instruction on three distinct levels. Teacher guides that are created for the series include worksheets and tests to form a full year of science curriculum. Note that these full science courses are developed for students who can read at the highest level.



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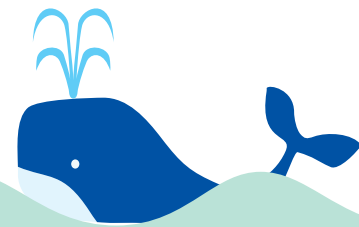
# HOW to use this BOOK



*The New Ocean Book* has been updated and designed with three educational levels in mind. These can be utilized for the classroom, independent study, or homeschool setting and also be customized per the abilities of the student. It is recommended that every reader examine the text on the white background, as this is the basic skill level information related to the material. More proficient students and those with increased interest in the subject matter can then proceed to the more advanced concept levels. Additionally, the most advanced readers, after having read through all levels of the material, can use the upper-level material as a springboard for independent research and other educational assignments (research papers, oral reports, presentations, imaginative projects, etc.).

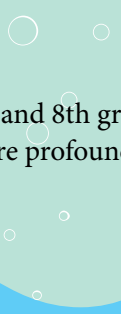
## LEVEL ONE

Text on the white background is developed for readers in the 5th and 6th grades. This basic level is presented for younger readers, and includes introductory materials and more general information about God's creation.



## LEVEL TWO

Text on the light mint green background is developed for readers in the 7th and 8th grades. This middle level delves deeper into oceanic discoveries, historical and scientific challenges, and more profound issues of oceans and God's presence at work around the world.



## LEVEL THREE

Text on the darker blue background is developed for readers in the 9th through 11th grades with a more expanded vocabulary. This upper level incorporates concepts and theories related to all subject matter included in the text, as well as unique information that is written on a more theoretical level. Readers will learn of more controversial and critical issues pertaining to scientific terms and data, dating methods, and more, all within the biblical perspective of God's creative design.



# CHAPTER 1

## Introduction to the Oceans

➤ Level 1 ➤ Level 2 ➤ Level 3

★ WORDS ★  
Photosynthetic organisms  
Ring of Fire

A snapshot of Earth from space reveals its nickname, the “Blue Planet.” With water covering 72 percent of its total surface area, Earth does indeed appear blue to any space traveler. Most of this blue coloring comes from Earth’s oceans, which contain 97 percent of all the surface water on the planet. Filling an average depth of 2½ miles, Earth’s oceans would cover the surface of her moon nine times!

Where did all the water come from? How were the oceans formed? Scripture tells us, “In the



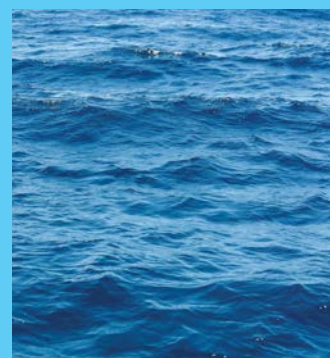
beginning God created the heaven and the earth” (Genesis 1:1). In the thirty verses to follow, the word water appears ten times. The apostle Peter also describes creation as “the earth standing out of the water and in the water” (2 Peter 3:5). The biblical account explains that God gathered these waters into seas and filled them with life. This was done for His pleasure and for our use. Water is a precious, essential gift from the Creator. As faithful stewards of the earth’s resources, it is important that

mankind understand the seas He created, so that they can take good care of them and everything in them.

If you are a landlubber nearing the shore for the first time, you will probably hear the ocean’s thundering power before you see its vast blue expanse. Perhaps you will view it from a lofty Pacific cliff, or as you trudge through Atlantic sands to the crashing surf. Welcome to the fascinating study of the world’s oceans — with all their beauty, power, flora, and fauna.

**THE COLOR OF WATER** God has given our planet such splendor, and our oceans are no different. People

find the beautiful blue, green, and turquoise colors of the oceans to be captivating. What causes a change in the water’s color? Water molecules scatter rays of sunlight as





The oceans contain the greatest number of living things on Earth. Many of the most amazing creatures in God's creation reside in the salty deep. Incredibly beautiful life forms inhabit the sparkling, sunlit waters of areas such as Australia's Great Barrier Reef.

The oceans can be thought of as protective, like a blanket that Almighty God has cast over the surface of the earth. Along with the atmosphere, the oceans help to regulate the climate and weather of the world. Because water is so effective in absorbing heat, the oceans act as heat reservoirs that moderate the cold of winter and the heat of summer. The oceans are also provisional, directly providing food for sustenance and life-giving oxygen released from tiny, free-floating

photosynthetic organisms. Most people know that plants supply the atmosphere with oxygen; what they do not know is that plants contribute only half of the oxygen. Those tiny ocean organisms produce the other half. Indirectly, the oceans provide precipitation by acting as the source of rain for crops. Heavy ocean breakers, tides, and currents also

*"You alone are the Lord; You have made heaven, The heaven of heavens, with all their host, The earth and everything on it, The seas and all that is in them, And You preserve them all. The host of heaven worships You." – Nehemiah 9:6*

reveal that our oceans are powerful, a source of almost limitless energy for man's potential use.

they enter the ocean. Most of the colors, except for the blue color, are absorbed or "soaked up." The blue wavelength, or color, is reflected back to your eyes and you see a blue ocean. Something as simple as clouds passing across the sun changes the ocean's color. The pigment chlorophyll and suspended organic material are also some of the contributors to the ocean's blue hue. Tiny yellowish creatures called phytoplankton live in oceans throughout the world. The combination of their yellow color with the ocean blue gives the waters of the world different shades from yellow to blue-green. Sediment particles washed into the ocean from rivers or stirred up from the ocean floor also affect the ocean's color. Greenish-looking water can

be due to phytoplankton mixed with tiny yellow-brown clay particles. When their colors combine with blue, a greenish color results. How do you suppose the Yellow Sea off the coast of China got its name?

Although three-quarters of the American population live within fifty miles of a coast, much about the oceans still remains a mystery. Scientists probably know more about the surface of the distant moon than the ocean bottom, cloaked in frigid darkness and crushing pressure. Truly, the mighty oceans with their mysterious deeps remain a vast and fascinating frontier.

## OCEANS AND SEAS OF THE WORLD

Arctic Ocean

Beaufort Sea

Baffin Bay

Hudson Bay

Greenland Sea

Labrador Sea

Caribbean Sea

North Atlantic Ocean

South Pacific Ocean

South Atlantic Ocean

### ANCIENT AND MODERN CONNECTIONS

Human history is closely connected to the oceans. As exploration continued through the decades, oceanographers saw the Gulf of Mexico, the Caribbean Sea, and the Mediterranean Sea as marginal seas of the Atlantic Ocean. They also distinguished the Antarctic Ocean from those oceans to its north. Today these vast bodies of water serve as a great liquid highway for commercial ships, act as borders between nations, supply one-third of usable natural gas and petroleum, and provide a major source of a variety of foods and recreation. Though the largest areas of water on Earth cycle together, scientists recognize five distinct oceans. Here they are in order of size: the Pacific Ocean, Atlantic Ocean, Indian Ocean, Southern Ocean, and Arctic Ocean. The Pacific Ocean is the largest on Earth. It is surrounded by an area of volcanic activity named the Ring of Fire. God's creative hand is clearly seen in preparing this planet with its life-supporting oceans for our habitation.





Norwegian Sea

North Sea

Black Sea

Caspian Sea

Mediterranean Sea

Red Sea

Arabian Sea

Bay of Bengal

Indian Ocean

South China Sea

Philippine Sea

East China Sea

Sea of Japan

Sea of Okhotsk

Bering Sea

North Pacific Ocean

Coral Sea

Tasman Sea

Southern Ocean

# CHAPTER 2

# Research and the Deep Oceans

➤ Level 1 ➤ Level 2 ➤ Level 3

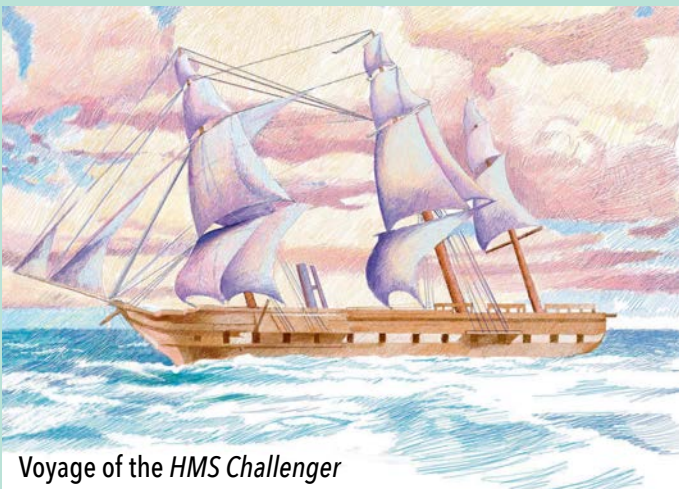
★ WORDS ★  
Oceanography  
Meteorology

Oceanography, or marine science, is the exploration and scientific study of phenomena associated with the world's seas, oceans, and their surrounding environment. This study involves such diverse fields as zoology, physics, meteorology, geography, geology and chemistry. (A student who would like to be an oceanographer must be good in math and chemistry.) Oceanography, a relatively young discipline, is important to many different fields, such as commerce (shipping products

between nations), defense (navies of various nations), engineering (construction and operation of seagoing structures and devices), communications (laying cables along the ocean bottom), safety (tracking icebergs), mineral and petroleum exploration (finding and recovering mineral deposits and oil), and meteorology (determining weather patterns). Scores of oceanographic research ships are presently monitoring events and collecting information on and below the surface of the sea.

This information will contribute to a greater understanding of the oceans God created.

Today, the following divisions of oceanography are chemical oceanography, physical oceanography, marine geology and geophysics, and biological oceanography. These disciplines overlap considerably, and a good oceanographer will be knowledgeable in all areas.



Voyage of the *HMS Challenger*

**VOYAGE OF THE HMS CHALLENGER** The first expedition devoted to oceanographic research was in December of 1872, when the *HMS Challenger* set out from England to conduct a three-and-a-half-year oceanographic expedition of the ocean floor, sea life, and seawater temperature and salinity. The *Challenger* staff of six scientists traveled 68,900 miles (110,860 km). Naturalists on board used weighted lines to sound (measure the depth of) shallower parts of the ocean, mapped very small sections of the ocean floor, studied ocean currents, and discovered more than 4,400 species of marine life. One theory the scientists wanted to examine was



The book of Genesis states the earth began as a watery chaos thousands of years ago. Water was present from the beginning. Secular scientists disagree and believe this planet was once a red hot sphere of sterile rock billions of years ago, believing there was no water present and no ideas to explain its origin.

## OCEAN RESEARCH VESSELS OF THE PAST

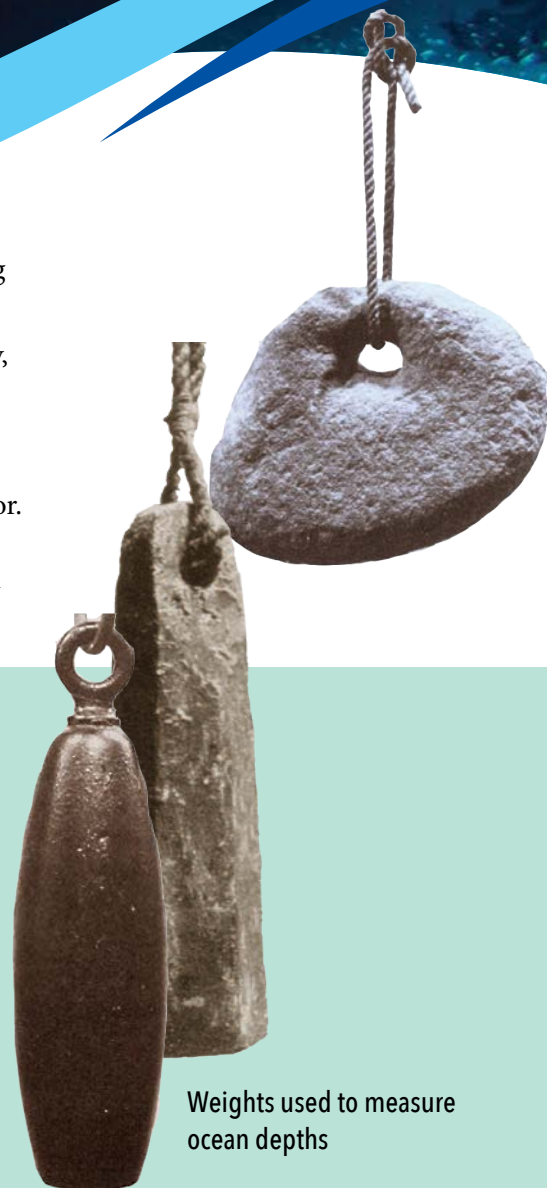
Researchers have come a long way since those early days of oceanographic studies. By the 1920s, the depth and shape of the ocean bottom was being determined by echo sounders. These devices send out a strong sound pulse that bounces or reflects off of a solid object, such as the sea floor, and returns to the source where it is recorded. In 1962, the *HMS Cook* recorded one of the deepest soundings ever in the Mindanao

Trench, the echo sounder registering over 7 miles (11,515 m)!

From the middle of the 20th century, technology has provided tools so sophisticated that the newly developed apparatuses could even study the earth's crust below the ocean floor. There has been more exploration of the ocean bottom since 1950 than in all the rest of recorded history.

Professor Edward Forbes's (1815-1854) claim that life below 1,800 feet (549 m) was impossible. Forbes felt that with such poor conditions as lack of light and high pressure, life surely could not exist. His claim was clearly proven wrong. Hundreds of samples were taken during the *Challenger* voyage from depths of over five miles (8,185 m) down. The scientists found a vast array of bizarre, previously undiscovered creatures.

Mysterious manganese nodules, first discovered on this expedition, were described as potato-shaped nodules ranging from walnut-size to grapefruit-size. Another significant discovery made on this voyage, a rise in the middle of the Atlantic Ocean, turned out to be the first clue to the extensive mid-oceanic ridge.



Weights used to measure ocean depths



## EXPLORING DEEPER WITH DRILLS AND SATELLITES

Today, ships are capable of generating a seismic profile (pictures made by sound waves) to view the composition of the ocean bottom. The devices that accomplish this task work in much the same manner as the echo sounders but are more powerful and use advanced technology.

The formidable Deep Sea Drilling Project (DSDP) was conducted from 1968 to 1983 by an international group of oceanographic institutions. Cores — thirty-foot (9.5 m) vertical, cylindrical columns of sediment and rock — were taken from the sea floor by a 400-foot-long drilling ship. After core samples were extracted from the ocean bottom, scientists sometimes placed sensors into the hole to gather more information, such as temperature readings. Scientists examined, and continue to examine, the composition of the thin multicolored bands of core sediments. Many thousands of core samples from various oceanic expeditions are stored in cold, hermetically sealed (airtight) rooms throughout the world. They remain, much like books in a library, available for further investigation when necessary.

In the mid-90s, the main emphasis of oceanography was exploration.

Certainly, a large amount was accomplished by traditional methods using ships, but Earth-orbiting satellites were increasingly used in a method that came to be known as satellite oceanography. Now, in the 21st century, oceanographers use everything from deep sea robots to these more sophisticated satellite images to further the fascinating field of oceanic research. Using satellites, scientists have determined where to penetrate the sea floor with drill holes tens-of-thousands of feet deep. Currently, NASA has a string of satellites orbiting the Earth called the 'A-train' because they are spaced just minutes apart on the same trajectory and altitude. Using these satellites and other tools, scientists are uncovering more detailed pictures of the complex three-dimensional ocean circulation.

After decades of research and exploration, there has been a dawning realization of the importance of the oceans. Many people no longer consider the high seas a huge sewer where refuse, waste and garbage may be conveniently disposed. Renewed efforts in marine ecology educate the public on the dangers of pollution and overfishing. Scientists and politicians alike are asking what should be done to ensure the wise and safe use of the oceans' resources.



In 2012 the deepest drilling to date was conducted by *R/V Chikyu*, a vessel of the International Ocean Drilling Program. The borehole went to an amazing depth of 25,394 feet (7,740 meters).



Satellites are often used to help scientists explore the oceans. Measurements such as scatterometry (wind direction and speed) and altimetry (height of the sea surface) are vital features.

# BRANCHES OF OCEANOGRAPHY

In the 21st century oceanographic research disciplines include marine geology and geophysics; ocean engineering; physical, biological, and chemical oceanography; and atmospheric science. Such areas of research are central to continued discoveries in science and give understanding to God's creation.



## MARINE GEOLOGY & GEOPHYSICS

the study of the nature and physics of the ocean's solid structure, including:

- ✦ all aspects of the continental slopes and shelves and the ocean basins



## CHEMICAL OCEANOGRAPHY

the study of:

- ✦ the chemical composition of seawater and material in suspension
- ✦ the nature of dissolved gases and solids
- ✦ chemical cycles like the carbon cycle
- ✦ the acidity of seawater in relationship to the ocean bottom and the atmosphere



## PHYSICAL OCEANOGRAPHY

includes the study of the physical features of the ocean's water, such as:

- ✦ temperature
- ✦ density
- ✦ waves
- ✦ currents
- ✦ tides
- ✦ sea ice
- ✦ air-sea interaction
- ✦ the ability to transmit sound and light



## MARINE BIOLOGY

the application of the scientific method to the ocean's animal and plant life, including:

- ✦ chemical and physical changes
- ✦ food webs
- ✦ the interaction of life with its surroundings
- ✦ and other related factors



## MARINE GEOLOGY

mainly studies oceanic sediments and rocks. Some common examples of marine geology are:

- ✦ petrology - study of the origin, composition, structure, and properties of rocks associated with the oceans
- ✦ sedimentology - the study of marine sediments
- ✦ geomorphology - the study of the origin of the seafloor and its modification by dynamic processes, such as volcanism, tidal actions, earthquakes, or tsunamis

The marine geophysicist, using physics and math, applies the properties of magnetism, gravity, electricity, heat flow, and seismic methods to the study of the oceanic crust and mantle.

