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Chapter 1 : Ocean Drilling Program: Glomar Challenger drillship

The DSDP was so successful that a new international Ocean Drilling Program (ODP) was created in Ocean floor drilling continues today with a larger and more technologically advanced ship, the JOIDES Resolution.

Early history[edit] Humans first acquired knowledge of the waves and currents of the seas and oceans in pre-historic times. Observations on tides were recorded by Aristotle and Strabo. Early exploration of the oceans was primarily for cartography and mainly limited to its surfaces and of the animals that fishermen brought up in nets, though depth soundings by lead line were taken. Franklin and Timothy Folger printed the first map of the Gulf Stream in â€” James Rennell wrote the first scientific textbooks on oceanography, detailing the current flows of the Atlantic and Indian oceans. During a voyage around the Cape of Good Hope in , he mapped "the banks and currents at the Lagullas ". In â€" Edward Forbes undertook dredging in the Aegean Sea that founded marine ecology. The first superintendent of the United States Naval Observatory â€" , Matthew Fontaine Maury devoted his time to the study of marine meteorology, navigation , and charting prevailing winds and currents. His textbook Physical Geography of the Sea was one of the first comprehensive oceanography studies. Many nations sent oceanographic observations to Maury at the Naval Observatory, where he and his colleagues evaluated the information and distributed the results worldwide. Almost nothing was known of the ocean depths. As exploration ignited both popular and scientific interest in the polar regions and Africa, so too did the mysteries of the unexplored oceans. The seminal event in the founding of the modern science of oceanography was the â€" Challenger expedition. As the first true oceanographic cruise, this expedition laid the groundwork for an entire academic and research discipline. Challenger , leased from the Royal Navy, was modified for scientific work and equipped with separate laboratories for natural history and chemistry. Challenger during the years â€" Murray, who supervised the publication, described the report as "the greatest advance in the knowledge of our planet since the celebrated discoveries of the fifteenth and sixteenth centuries". He went on to found the academic discipline of oceanography at the University of Edinburgh , which remained the centre for oceanographic research well into the 20th century. In the late 19th century, other Western nations also sent out scientific expeditions as did private individuals and institutions. The first purpose built oceanographic ship, Albatros, was built in In , Fridtjof Nansen allowed his ship, Fram, to be frozen in the Arctic ice. This enabled him to obtain oceanographic, meteorological and astronomical data at a stationary spot over an extended period. The first acoustic measurement of sea depth was made in Between and the "Meteor" expedition gathered 70, ocean depth measurements using an echo sounder, surveying the Mid-Atlantic ridge. Sverdrup, Johnson and Fleming published The Oceans in , [12] which was a major landmark. The Sea in three volumes, covering physical oceanography, seawater and geology edited by M. The theory of seafloor spreading was developed in by Harry Hammond Hess. The Ocean Drilling Program started in The United States nuclear submarine Nautilus made the first journey under the ice to the North Pole in From the s, there has been much emphasis on the application of large scale computers to oceanography to allow numerical predictions of ocean conditions and as a part of overall environmental change prediction. Geosat seafloor mapping data became available in Study of the oceans is linked to understanding global climate changes, potential global warming and related biosphere concerns. The atmosphere and ocean are linked because of evaporation and precipitation as well as thermal flux and solar insolation. Wind stress is a major driver of ocean currents while the ocean is a sink for atmospheric carbon dioxide. Oceanographic frontal systems on the Southern Hemisphere The study of oceanography is divided into these four branches: Biological oceanography, or marine biology , investigates the ecology of marine organisms in the context of the physical, chemical and geological characteristics of their ocean environment and the biology of individual marine organisms. Chemical oceanography and ocean chemistry , are the study of the chemistry of the ocean. Whereas chemical oceanography is primarily occupied with the study and understanding of seawater properties and its changes, ocean chemistry focuses primarily on the geochemical cycles. Geological oceanography, or marine geology , is the study of the geology of the ocean floor including plate tectonics and paleoceanography.

Chapter 2 : Deep Sea Drilling Project | racedaydvl.com

Oceanography, ocean drilling memorandum of understanding between the United States of America and the United Kingdom of Great Britain and Northern Ireland, signed at Washington January 13,

Most human beings live on or near coastlines, and human history is closely linked to the oceans. They serve as a source of food, as the key to weather and climate, and as the highways for ships of commerce. Much of the history of the planet itself is recorded in the bottom topography, geophysical properties, and sediments of the oceans. The modern discoveries that have revolutionized geological thinking have in fact largely been the product of work in the ocean sciences. Historical Background Humans have observed the oceans since ancient times. The interest of early civilizations centered mainly on practical matters, such as gathering lore on the ways of sea life and on the tides and other ocean phenomena affecting the shores. With the development of ships, ocean studies were again principally concerned with practical matters such as the charting of seaways to aid navigation. Sailors also made soundings of ocean depths and gathered data on such phenomena as winds, ocean currents, water temperatures, and ice movements on the northern seas. Oceanography as a science began in the 19th century with the work of such men as U. The first major scientific expedition, and the one that firmly established the field of oceanography, was the around-the-world voyage of H. Setting out from England in , the Challenger Expedition returned three years and five months later with a wealth of information on the physical and chemical characteristics of seawater and bottom sediments, as well as the first comprehensive data on the distribution of organic life at all water depths and on the seafloor. Following this voyage, oceanographic research was generally conducted either on short cruises that concentrated on small areas of the ocean, or on long cruises with limited objectives pursued in widely separated small areas. The South Atlantic voyage of the German ship Meteor in was the first to use an echo sounder to chart the ruggedness of the ocean bottom in a continuous manner, rather than making scattered and separate soundings. Modern Oceanographic Disciplines Modern oceanography is a combination of several fields of science, and it is conventionally divided into the subdisciplines of physical, chemical, biological, and geological oceanography. Closely associated fields are those of marine technology, maritime law, and studies of the effects of ocean pollution. Physical oceanographers study the physical processes underlying such phenomena as currents; tides; water waves; water transparency, density, and temperature; and underwater acoustics and sound transmission. The latter subjects are also important for submarine technology. Chemical oceanographers are concerned with the chemistry of seawater, its major salts, and its many trace elements. Marine biologists study life in the sea, marine ecology, and the total organic production in the oceans. Ocean life comprises the floating or weakly swimming forms called plankton and the rapidly swimming forms called nekton, as well as deep-sea life and various bottom dwellers. Marine geologists map the ocean floor, analyze shoreline problems, and study sediments of the ocean floor and rocks of the underlying crust. As a whole, modern oceanography is pursued mainly at a few major centers around the world. The research goals within such centers tend to focus on intense studies of smaller ocean areas by teams representing each of the broad oceanographic disciplines. In addition to work at such centers, a new era of oceanwide research was initiated when international scientific teams organized to tackle programs too vast in scope to be handled by individual institutions. One notable undertaking of this nature, the Deep-Sea Drilling Project, was conducted from to by a consortium of U. That program was succeeded in by a similar but more advanced program, the Ocean Drilling Program. The World Ocean Circulation Experiment, conducted from to , studied the effects of the oceans on climate. Oceanwide mapping programs were also pursued in the s, and ocean currents are being studied using remote-sensing data gathered by Earth satellites. International ocean-study programs of several kinds are likewise making use of such satellites. By , thermometers were devised that could be lowered to great depths and then "locked" on the temperatures recorded there as they were raised. Water samples were taken from all depths by Nansen bottles, metal tubular containers with ends that could be shut by "messenger" devices. By the time of World War I, echo-sounding gear was available that timed the passage of a sound pulse to the ocean bottom and back. Thereafter a huge variety of specialized ocean instruments became available. Ocean currents are tracked offshore by constant-depth floats that report their position acoustically, while sea-bottom currents are measured by devices called inclinometers. In the nearshore area, currents are followed by drifting devices or measured by underwater current meters, while wave and tidal motions are usually followed by pressure cells or by stationary floats hooked to recorders. Some instruments operate on floating or underwater buoys. Oceanographers also collect and correlate biological data in order to determine the bioproductivity and health of a given ecosystem. Current speed and direction meters collect data at different depths on tidal, nearshore, offshore, and deep-ocean currents. Wave meters provide researchers with data on wave height, length, and direction. Mechanical and visual tide gauges have long been used, and electronic sensors are now employed to telemeter tidal data to central processing centers with computer outputs. Nautical charts are updated by means of sensitive fathometers along with accurate navigational aids and satellite photographs, the data being computer-corrected to zero-tide values. Thermoclines, or temperature differences with depth, for a long time were measured with mechanical bathythermographs, devices that could simultaneously record temperatures and depths down to about m ft. Disposable electronic instruments of this kind are now employed. Using thermistors and pressure sensors, these instruments are connected to the surface by a small wire that feeds off an internal spool, allowing readings to be made from ships while under way. Mechanical temperature meters are used for long-term monitoring of power-plant discharges. Waterproofed photoelectric cells measure the amount of light that passes through water to different depths, relative to a surface reading. Secchi disks are used to measure visibility and provide a measure of water turbidity. These data are important, because the amount of solar energy that is present directly affects the bioproductivity of a given body of water. How sound is transmitted through water, along with the effects of different frequencies, is also a subject of oceanographic research. Low-frequency sound waves, for example, travel around the Earth in the deep-ocean trenches. The detection and identification of sounds made by deep-sea life is a study all its own. Modern instrumentation allows researchers to correlate vast and diverse quantities of data by means of computers so as to determine the factors that may affect a given ocean ecosystem. Historically, water samples were taken at different depths and analyzed through painstaking processes. Today instrumentation packages called "fish," which can be lowered on a cable, are capable of continuous sampling, with the data being fed directly to a computer. A typical "fish" may collect data on depth, temperature, salinity, turbidity, oxygen, carbon dioxide, and specific heavy metals and pollutants on a single lowering. NOAA uses so-called monster buoys doughnut-shaped, self-contained telemetering devices that provide meteorological information from remote, seldom-traveled ocean areas. They transmit data on barometric pressures, wind speeds and directions, and wave heights and directions to shore-based monitoring stations for analysis. When combined with satellite and nearshore sensory data, this information enables forecasters to predict weather, sea, and swell conditions. Such predictions are vital for shipping and other offshore operations. The composition of the seabed is usually examined by collecting samples. Mechanical devices called "grabs" snap shut upon touching the bottom, while dredges are towed across the bottom by ships. Instruments for collecting cores are lowered by winch and allowed to fall freely, driven by negative buoyancies of a ton or more. In softer sediments the sharpened lower end of a corer may penetrate the ocean bottom as deeply as 10 m 33 ft. Very deep coring samples are obtained by specifically designed drilling cranes. Deeper probes are achieved by using strong acoustic pulses that can penetrate thousands of meters, sending back echoes that reveal underlying rock strata. Oceanographers can explore the ocean directly by using scuba diving equipment or more complex deep-sea diving systems. Deeper descents require some kind of a pressure vessel such as a bell or submarine. The first oceanographic device of this sort was the bathysphere, a hollow steel ball built in , which had to be lowered and raised by a cable. Since that time several true submersibles, or steerable underwater craft, have been built. In the mids Alvin was used to observe hydrothermal vents and also to visit the wreckage of the famous ocean liner Titanic. Another craft, Pisces, is a Canadian submersible that can carry a variety of packages for specimen, bottom, and water sampling. Flip is a semisubmersible ship that is towed into position, where it assumes a vertical position with most of its length underwater and then drifts with the offshore currents. It was designed as a platform and housing unit for long-term data collection and observation. Such craft, and attendant robot craft operated by remote control ROVs, for Remotely Operated Vehicles , can be equipped with many instruments and cameras as well as with mechanical arms. Underwater habitats offer scientists the opportunity to spend time living at a given location in relative comfort while doing their work. Navy saturation experiments that Capt. George Bond initiated in led to the Sealab experiments that set the stage for these habitats. French oceanographer Jacques Yves Cousteau conducted several such programs in the early s. It was moved to the Bahamas in and installed at a depth of 9 m 30 ft , moved to St. Croix in , and retired in after nearly missions. Tektite, originally designed as a space station, was used in the U. Virgin Islands in and for two missions involving physiological, oceanographic, and biological studies. Prinul, which operated off Puerto Rico from to , enabled scientists to conduct two-week missions while living at depths of from 15 m 50 ft to more than 30 m ft and, sometimes, working at depths of more than 70 m ft. Aquarius, operated by NOAA, is designed for depths of up to 37 m ft.

Chapter 3 : Oceanography | Scholastic

The Ocean Drilling Program (ODP), begun in and supported by a U.S.-led consortium that included 25 nations, was the successor of the Deep Sea Drilling Project. The program employed the drillship JOIDES Resolution and was managed by Joint Oceanographic Institutions (JOI).

Oceanography, Geological Oceanography, Geological Geological oceanography is the study of Earth beneath the oceans. A geological oceanographer studies the topography, structure, and geological processes of the ocean floor to discover how the Earth and oceans were formed and how ongoing processes may change them in the future. Geological oceanography is one of the broadest fields in the Earth Sciences and contains many subdisciplines, including geophysics and plate tectonics , petrology and sedimentation processes, and micropaleontology and stratigraphy. Geological oceanographers study many features of the oceans such as rises and ridges, trenches, seamounts, abyssal hills, the oceanic crust, sedimentation clastic, chemical, and biological , erosional processes, volcanism , and seismicity. Tools and Techniques Many different tools are used by geological oceanographers. For example, the structure and topography of the ocean floor are studied through the use of satellite mapping, which measures the level of the ocean surface to estimate the shape of the ocean floor. A detailed study in by the National Oceanic and Atmospheric Administration NOAA involved the Seasat satellite which produced frequent, short pulses of microwave radiation to measure the level of the surface of the sea with great accuracy within 3 centimeters or 1 inch. The stronger gravity near high massive formations attracts more water molecules, raising the level of the ocean slightly. Similarly valleys on the ocean floor produce weaker areas of gravity, so the level of the ocean will be lower. Using this technique, a complete survey of the ocean floor was accomplished. Seismic techniques are used to measure the subsurface structure. This type of study is carried out by teams of two ships: Some waves travel directly to the second ship; others travel to the ocean floor, are refracted bent within the layers of sediment, and then travel to the second ship. By measuring the time it takes for the energy to arrive and the distance between the boats, the thickness of sediments and other features can be determined. Structures may also be analyzed by studying natural earthquake waves that travel through deeper oceanic rocks and may be recorded at stations around the world. Geological oceanography and coastal geology are closely related yet distinct disciplines. Geological oceanographers study the rocks and structure of the ocean floor, the oceanfloor sediment that covers them, and the processes that formed them. Coastal geologists focus on these structures and processes in a coastal environment shown here. Other ways oceanic sediments are studied are by dredging processes and deep-sea exploration projects such as the Ocean Drilling Program ODP , which obtains samples of seafloor sediment from the entire world. The ocean sediments are found to consist of rock particles and organic remains whose compositions depend on depth, distance from continents, and local variations such as submarine volcanoes or high biological activity. For example, clay minerals, which are formed by the weathering of continental rocks, are carried out to sea by rivers and are usually abundant in the deep sea. Thick deposits of weathered rock material, commonly coarser than deep-sea clays, are often found near the mouths of rivers and on the continental shelves. Universities and private individuals, as well as governments, have established institutions and programs for the study of the ocean; today about such entities exist. Examples include the Ocean Drilling Program, funded by the U. National Science Foundation and 22 international partners to conduct research into the history of ocean basins and the nature of the crust beneath the ocean floor; Sea Grant, a university-based program that receives support from the U. Department of Commerce through NOAA and that studies all aspects of the ocean, including geological, chemical, and physical processes; and RIDGE Ridge Interdisciplinary Global Experiments , a program funded by the National Science Foundation whose the primary objective is to understand the geological, chemical, biological, and physical oceanographic interactions between the oceans and the midocean ridge system, which forms the plate tectonic boundaries between diverging plates.

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Chapter 4 : Oceanography, ocean drilling (edition) | Open Library

The history of ocean drilling at Scripps Institution of Oceanography, UC San Diego, dates back more than a half century and now the arrival of a new hub for research drilling at the Scripps campus promises to continue that legacy.

The ship was launched on March 23, , from that city. Technical and scientific reports followed during a ten month period. Phase II ended on August 11, , and ship began a successful scientific and engineering career. The success of the Challenger was almost immediate. On Leg 1 Site 2 under a water depth of m ft , core samples revealed the existence of salt domes. Oil companies received samples after an agreement to publish their analyses. The potential of oil beneath deep ocean salt domes remains an important avenue for commercial development today. But the purpose of the Glomar Challenger was scientific exploration. One of the most important discoveries was made during Leg 3. The crew drilled 17 holes at 10 different sites along a oceanic ridge between South America and Africa. The core samples retrieved provided definitive proof for continential drift and seafloor renewal at rift zones. The samples gave further evidence to support the plate tectonics theory of W. Jason Morgan and Xavier Le Pichon. The theory of these two geologists attempts to explain the formation of mountain ranges, earthquakes, and deep sea trenches. After analysis of samples, scientists concluded that the ocean floor is probably no older than million years. This is in comparison with the 4. As the seafloor spreads from the rifts, it descends again beneath tectonic plates or is pushed upwards to form mountain ranges. The ship retrieved core samples in 30 ft long cores with a diameter of 2. After splitting the core in half length-wise, one half was archived and the other is still used as a source to answer specimen requests. Although itself a remarkable engineering feat, the Challenger was the site of many advances in deep ocean drilling. One problem solved was the replacement of worn drill bits. A length of pipe suspended from the ship down to the bottom of the sea might have been as long as 20, ft m as was done on Leg 23 Site The maximum depth penetrated through the ocean bottom could have been as great as 4, ft m as at Site To replace the bit, the drill string must be raised, a new bit attached, and the string remade down to the bottom. However, the crew must thread this string back into the same drill hole. The technique for this formidable task was accomplished on June 14, , in the Atlantic Ocean in 10, ft m of water off the coast of New York. This re-entry was accomplished with the use of sonar scanning equipment and a re-entry cone which had a diameter of 16 ft 4. Parts of the ship, such as its dynamic positioning system, engine telegraph, and thruster console, are stored at the Smithsonian Institution. From August 11, , to November 11, an impressive list of statistics were compiled: Total distance penetrated below sea floor , m.

Chapter 5 : Ocean Drilling Program: Science Operator

The initial award to Scripps Institution of Oceanography for DSDP was for an eighteen-month drilling program in the Atlantic and Pacific Oceans. Leg 1 listed 28 shipboard participants - all American and all men - with the majority being engineering and technical staff.

Probing the Seafloor Polynesian Seafarers Masters of Ocean Currents About 30, years ago, human cultures along the western coastline of the Pacific Ocean started to migrate eastward across the great expanse of the Pacific Ocean. Ancient Myths About the Oceans The people who lived around the Mediterranean Sea began exploring this nearly landlocked sea several thousand years ago. Voyages of Exploration and Science: The Age of Discovery About years ago, European explorers turned to the sea to find faster trade routes to cities in Asia and Europe. Discovering the Gulf Stream Besides being a famous statesman and diplomat, Benjamin Franklin was a well-known American scientist. He contributed to oceanography in the mid- to late s by making and compiling good observations of ocean currents off the US East Coast. Charles Darwin and the Voyage of the Beagle In , and in the teeth of a gale, the HMS Beagle, a British warship, left Devonport, England, for an expedition to map the South American coastline and to carry out chronometer surveys all over the globe. The Challenger Expedition Modern oceanography began with the Challenger Expedition between and It was the first expedition organized specifically to gather data on a wide range of ocean features, including ocean temperatures seawater chemistry, currents, marine life, and the geology of the seafloor. The Oceans as Battlefield: The Development of Sonar The oceans have always played a big role in wars. Ships transported armies and supplies, blockaded harbors, besieged cities, and attacked enemy ships doing the same things. But the Civil War helped launch a stealthy new seagoing weapon that became common in 20th century warfareâ€"submarines. Continental Drift and Seafloor Spreading: They believed that the oceans and continents were always where they are now. Probing the Seafloor Oceanographers had been able to collect sediment and rock samples from the ocean bottom ever since the Challenger Expedition. But they did not have the technology to enable them to probe very far beneath the seafloor. Oceanography in the 21st Century: Inner Space Exploration Most of the major discoveries in oceanography have occurred only within the last 50 years. Oceanographers had been able to collect sediment and rock samples from the ocean bottom ever since the Challenger Expedition. In , an international group of oceanographic institutions and the U. National Science Foundation created a program of ocean drilling. For 25 years, the Deep Sea Drilling Project DSDP operated the Glomar Challenger, a research ship feet meters in length that was equipped with a drilling platform and scientific laboratories. From this platform, a string of pipes descended through water 20, feet about 6, meters deep into the ocean bottom. At the end of the pipes was a drill that cut into the seafloor. The system collected long, thin cylinders meters long and centimeters wide of sediment and rock from beneath the seafloor, called cores. The cores provided evidence to confirm seafloor spreading and plate tectonics, but they also revealed much more. Many of these clues cannot be found in rocks on land, because they are eroded away. But they are well-preserved below the seafloor. This foot meter ship can drill in water that is 27, feet 8, meters deep! It can dangle 30, feet 9, meters of drill pipe through the hole in the center of the ship called the "moon pool". In addition, it has 10 laboratories where scientists can analyze the cores during cruises that typically last two months. On drill ships, the sediment and rock cores are brought up from the bottom through the inside of the drill pipe in 30 feet long 9. Once on the deck of the ship, they are split in half. The other is stored in special repositories, often called core libraries. Scientists from all over the world can come to these libraries and examine cores from all over the oceans-much the way you might go to a library to find a book. These core repositories will be a very valuable scientific resource for many years to come. The Glomar Challenger was the first drilling vessel to be used for scientific research by the Deep Sea Drilling Project. The drilling crew attach a piece of drillpipe hanging from the derrick the tall structure to the drillstring that is already below the ship the top of the drillstring is the brown metal piece sticking above the red structure. Technicians clean off the core of mud that has been retrieved from the seafloor in a plastic sleeve. They then cut the 6. The Woods Hole Oceanographic Institution is dedicated to advancing knowledge of the ocean and its connection with the

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Earth system through a sustained commitment to excellence in science, engineering, and education, and to the application of this knowledge to problems facing society.

Chapter 6 : Oceanography, Geological - sea, depth, oceans, system, marine

The Deep Sea Drilling Project drilled about holes into the ocean floors over the world, about one hole per , square mi (, square km). The Ocean Drilling Program (ODP), begun in and supported by a U.S.-led consortium that included 25 nations, was the successor of the Deep Sea Drilling Project.

Chapter 7 : Oceanography of Australia - Marine Science Australia

Oceanography (compound of the Greek words á½ Îºá½µÎ±Î½ÏŒÏ‚ meaning "ocean" and Î³Ï•Î¬Ï†Ï‰ meaning "write"), also known as oceanology, is the study of the physical and biological aspects of the ocean.

Chapter 8 : Deep Sea Drilling Project - Wikipedia

The Deep Sea Drilling Project (DSDP) was the first of three international scientific ocean drilling programs that have operated over more than 40 years. History It was on June 24, , that the Prime Contract between the National Science Foundation (NSF) and The Regents, University of California was signed.

Chapter 9 : Ocean Drilling - Dive & Discover

The Ocean Drilling Program (ODP) is an international organization that conducts basic research into the history of the ocean basins and the nature of the crust beneath the ocean floor.