A TREASURE CHEST OF CORES

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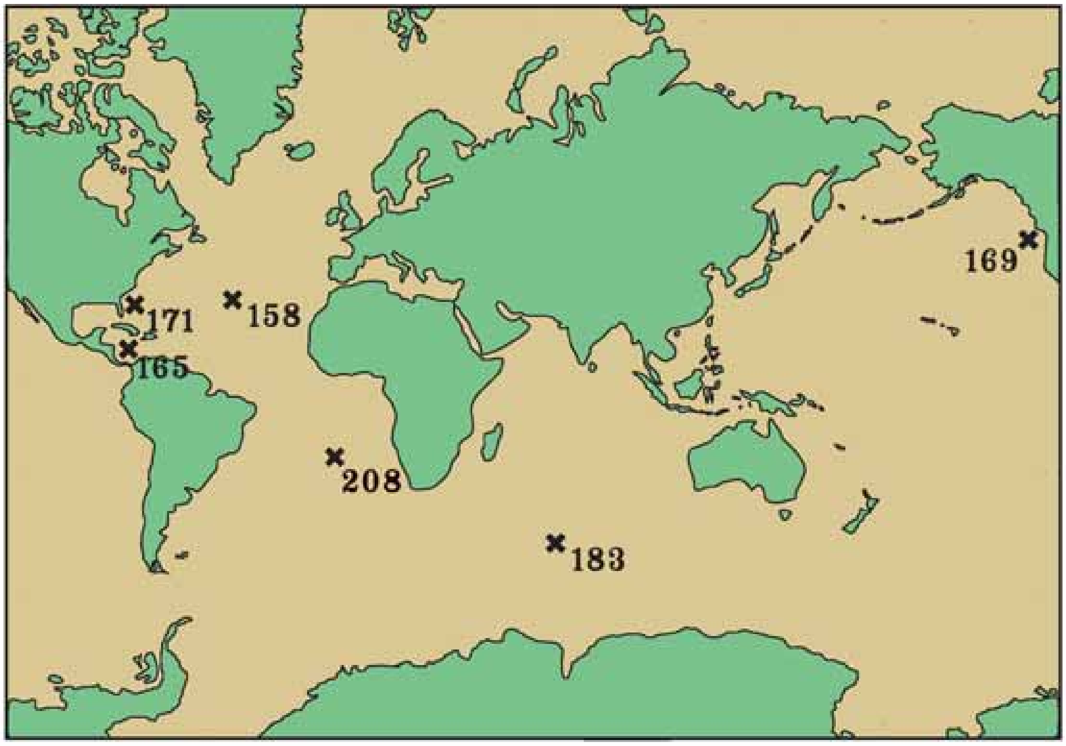

From the first drill site of the Deep Sea Drilling Project back in 1968, through cores recovered during the Ocean Drilling Program between 1985 and 2003, to the cores recovered on the JOIDES Resolution last week for the Integrated Ocean Drilling Program, the combined ocean drilling programs have recovered more than 56,000 cores. That's a lot of rock and sediment. But, more importantly, these cores represent a treasure chest of scientific knowledge, filled with information about Earth's history, structure, and processes. All 56,000 cores have been tested, sampled, studied, examined, and dissected to get every possible ounce of scientific data out of them. Each core provides a key to unlock part of that giant treasure chest, and scientists who study the cores are continually finding new keys to see what the treasure chest will reveal next. The six cores below represent some of the most amazing discoveries in the history of the ocean drilling programs. For more information on the cores and the expedition during which they were recovered, please visit the web sites below each core description. Photographs of each core are shown on page 23.

<u>Leg 171, Hole 1049A, Core 17X, Section 2, 45–85 cm</u>

Collected during Leg 171 in 1997, this sediment core records the giant asteroid impact event that changed life on Earth 65 million years ago. The core shows the effects of the impact as a brown-orange fireball layer made up of dust and ash fallout. By studying the fossils of microorganisms found in the sediments below and above this impact layer, scientists have been able to estimate how many species of these ancient marine organisms became extinct after the impact. Scientists also learn about ancient climate and environmental conditions by studying these sediments.

<www-odp.tamu.edu/publications/leg_ndx/171bndex.htm>

Leg 158, Hole 957C, Core 11N, Section 1, 70–110 cm

This core, collected from a hydrothermal mound near the Mid-Atlantic Ridge in 1994, showed for the first time that hydrothermal ores are deposited both above and below older sediments. Before Leg 158, scientists thought that these brecciated (coarse grained with angular rock fragments) ore deposits formed by tectonic deformation; however, study of this core showed that this brecciation is not caused by tectonic forces but occurs in place, greatly increasing our understanding of these important ore deposits.

<www-odp.tamu.edu/publications/leg_ndx/158ndex.htm>

Leg 183, Hole 1137A, Core 34R, Section 3, 60–110 cm

Scientists were surprised to recover this core, a river deposit of cobbles and pebbles containing garnet-biotite gneiss (rock from the continental crust, or land) in the middle of the Indian Ocean during Leg 183 in 1998. This conglomerate rock that had formed on land was buried deep in the middle of a thick sequence of volcanic basalt (rock from the oceanic crust) that makes up the Kerguelen Plateau large igneous province. This core showed that a piece of the ancient India/Antarctica/Australia supercontinent broke off and was then covered by massive ocean floor volcanic flows that built the plateau over 100 million years.

<www-odp.tamu.edu/publications/leg_ndx/183ndex.htm>

Leg 208, Hole 1263D, Core 4H, Section 1, 45–90 cm

Drilling on Walvis Ridge in the South Atlantic Ocean in 2003 uncovered this core, which shows evidence of the extreme climate warming event that occurred at the Paleocene/Eocene boundary (~54 million years ago). Many Paleocene/Eocene boundary cores had been recovered previously, but this core showed that carbonate dissolved at a very shallow depth at this site, providing evidence to support the theory that the Paleocene/Eocene boundary warming event was caused by release and dissolution of as much as 2000 gigatons of marine methane hydrate (crystallized methane) from below the seafloor.

<www-odp.tamu.edu/publications/leg_ndx/208ndex.htm>

Leg 165, Hole 1002C, Core 1H, Section 4, 40–115 cm

In this core, from the Cariaco Basin off Venezuela, scientists found a detailed record of climate change during the early Holocene (~8,000–10,000 years ago). The core shows that during this time there was a dramatic shift from thinly layered, dark, organic-rich sediments (indicating a warm climate with high biological productivity) to gray nonlayered sediments (indicating a cooler climate with low biological productivity). These changes correlate with climate changes indicated in Greenland ice cores for the same time period, leading to the important discovery that tropical regions of the Earth play a significant role in global climate change.

<www-odp.tamu.edu/publications/leg_ndx/165ndex.htm>

Leg 169, Hole 856H, Core 31R, Section 1, 87.5–135 cm

This core, collected in the northeast Pacific Ocean in 1996, caught the attention of the land-based mining industry. It shows a stratified zone of copper-rich mineralization below a sulfide deposit. No one had ever seen copper mineralization of this type and size before. Not only did this discovery help us understand more about how these ore deposits form, but it revealed a new target for land-based mineral exploration.

<www-odp.tamu.edu/publications/leg_ndx/169ndex.htm>

Correction

On page 28 of the Spring 2005 issue of *The Earth Scientist*, the URL attributed to Science Education Solutions' SpiNet program was incorrect. Please make note of the correct web site address - <www.scieds.com/spinet/>.

Drilling Through Time

The ocean floor provides an ideal location to explore Earth history because deep-sea sediment and rock layers are generally much more continuous and less disturbed than comparable formations on continents, which are exposed to the erosional forces of wind, precipitation, rivers, and sea level fluctuations. The Ocean Drilling Programs have recovered sediments ranging in age from the last decade all the way back to the Triassic Period, nearly 227 million years ago.

Era	Period	Period/Epoch	Beginning (million years ago)	Duration (million years)	Development of life on Earth
CENOZOIC ERA	Quaternary Period	Holocene Epoch	0.01	0.01	Humans hunt and tame animals, develop agriculture, use metals, coal, gas, wind, and water power, and other resources
		Pleistocene Epoch	1.8	1.79	Modern humans develop and mammoths, woolly rhinos, and other animals flourish but die out near end of epoch
	Tertiary Period	Pliocene Epoch	5.3	3.5	Sea life, birds, and many mammals similar to modern ones spread around the world, humanlike creatures appear
		Miocene Epoch	23.8	18.5	Apes in Asia and Africa, other animals include bats, monkeys, whales, primitive bears and raccoons; flowering plants and trees resemble modern ones
		Oligocene Epoch	33.7	9.9	First primitive apes, development of camels, cats, dogs, elephants, horses, rhinoceroses, and rodents; huge rhinoceros-like animals disappear near end of period
		Eocene Epoch	54.8	21.1	Plentiful birds, amphibians, small reptiles, and fish joined by primitive bats, camels, cats, horses, monkeys, rhinoceroses, and whales
		Paleocene Epoch	65.0	10.2	Flowering plants plentiful, invertebrates, fish, amphibians, reptiles, and mammals common
MESOZOIC ERA		Cretaceous Period	142.0	77	First flowering plants; horned and armored dinosaurs common; plentiful invertebrates, fish, and amphibians; dinosaurs disappear at end of period
		Jurassic Period	205.7	63.7	Dinosaurs at maximum size; first birds, shelled squid; mammals are small and primitive
		Triassic Period	248.2	42.5	First turtles, crocodiles, dinosaurs, and mammals; fish resemble modern kinds

Time scale adapted from "a Phanerozoic Time Scale" by F.M. Gradstein and J.G. Ogg, Episodes, vol 19, no's 1&2, 1996.