

The Silent Landscape

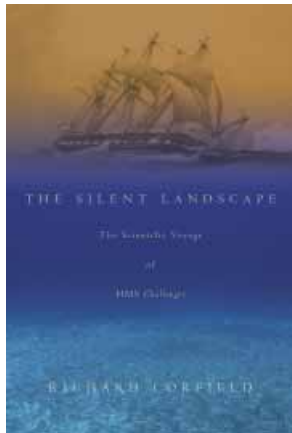
THE SCIENTIFIC VOYAGE OF HMS CHALLENGER

A BOOK BY RICHARD CORFIELD

REVIEWED BY BOB FREEMAN

304 pages, National Academies Press, 2003, ISBN 0-309-08904-2, Hardcover, \$24.95

In *The Silent Landscape*, scientist and science writer Richard Corfield relates the story of one of the most important scientific expeditions of the 19th Century, an expedition that would forever change the way we view the world's oceans. The story



concerns the three-and-one-half year voyage (1872-1876) of HMS *Challenger*, the incredible scientific discoveries made during the voyage, and the triumphs and tragedies of *Challenger's* bold and dedicated crew. It is a wonderful story, and the author knows how to spin a good yarn.

In writing his book, Corfield draws upon the astonishingly comprehensive 50-volume scientific report of the expedition, as well as the personal diaries and memoirs of a cross-section of the crew members including a terrestrial naturalist, a junior engineering officer, a navigation officer, a British aristocrat, and an assistant ship's steward. From these accounts, Corfield is able to recreate the personal, and human side, of this remarkable expedition. The result is a great adventure story, one that captures the insatiable and sometimes reckless curiosity of the 19th Century spirit.

There had been previous important voyages that expanded our knowledge and understanding of the physical world, such as the voyage of HMS *Beagle* from 1831-1836 where the young naturalist Charles Darwin first formulated his theories about natural selection and the evolution of life. But these voyages were primarily naval expeditions focused

on resource exploration and territorial annexation, relegating scientific discovery to a collateral and subordinate position. The *Challenger's* voyage was unique in that it was outfitted primarily for scientific exploration.

The voyage was sponsored by the Royal Society of London, which set the mission objectives: 1) to investigate the physical conditions of the deep sea basins; 2) to determine the chemical composition of seawater at various depths, the organic matter in solution and particles in suspension; 3) to ascertain the physical and chemical character of deep-sea deposits and their sources; and 4) to investigate the distribution of organic life at different depths and on the seafloor. In short, the *Challenger* was tasked to investigate the geology and natural history of the sea in as much of the world as could be investigated in the allotted three-and-one-half years.

At the heart of these mandates was a contentious issue: the azoic theory, a popularly accepted view that marine life could not exist below depths of 300 fathoms (1,800 feet). It was believed that the deep ocean floor was a lifeless abyss (hence the title *The Silent Landscape*), but Wyville Thompson, professor of natural history at the University of Edinburgh, challenged this theory. Thompson convinced his influential friends at the Royal Society to support him in an expedition to systematically and scientifically investigate the claims of this theory.

The Society was able to secure a frigate from the British Admiralty, HMS *Lightning*, and in a precursor to the *Challenger's* expedition, Wyville's subsequent investigation dredged up remnants of organic material below 600 fathoms. He also discovered that below 200 fathoms the water column essentially became isothermal (i.e., maintained a constant temperature). This latter discovery was the first evidence of the existence of deep-water currents with their own thermal and physical characteristics.

The success of Thompson's investigations fired the imagination of the Victorian World, and ultimately led to the commissioning of the more extensive *Challenger* expedition. *Challenger's* success in capturing and documenting hundreds of deep-ocean species from all the major oceans (except the Arctic) forever put to rest the azoic theory and gave Victorian society its first glimpse of the wondrous diversity of life at the bottom of the sea.

Corfield proposes that there was another motive for this expedition, one that continues to exist today. Only fourteen years ear-

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lier, Charles Darwin had rocked the world with the release of his theory of natural selection. Darwin proposed that marine organisms found on land only as fossils would still be found living in the oceans. The supporters of Darwin hoped that the expedition would provide the fossil evidence to support what was viewed as a battle between the followers of God and of science, or a battle between faith and logic.

In his book, Corfield relates the more dramatic events and discoveries of the *Challenger* expedition, but like any good spinner of a yarn, he frequently strays from the main narrative to explore related side stories. He talks about the personalities of the major participants, and the stresses and challenges of 270 men living at sea, confined on a 200-foot long, 40-foot wide Royal Navy corvette (a type of warship), that had been converted into a floating laboratory.

Using a primitive 1,234 horse power steam engine to provide more power and maneuverability to the primarily sail-powered ship, *Challenger* represented the cutting-edge of Victorian technology. Corfield uses this discussion as a departure point to relate the subsequent history of the development of ocean survey technology and modern methodologies.

Many of *Challenger's* more important discoveries were not well-understood at the time, but would later lead to major breakthroughs in knowledge of the ocean environment. For instance, Corfield explains how *Challenger's* survey of the European continental slope, and the crew's confirmation of the existence of the mid-Atlantic Ridge, ultimately led to an understanding of plate tectonics. Corfield then recounts in detail the history and development of plate tectonic theory.

On March 23, 1875, in waters near the Mariana Islands, *Challenger* took a sounding (a pre-sonar depth measurement using rope [twine]) that indicated a depth of 4475 fathoms (roughly 27,000 feet). *Challenger's*

crew had discovered the deepest part of the world's oceans, the Marianas Trench, and Corfield uses this discovery to detail the subsequent exploration of the Marianas Trench and the first attempts at deep-sea diving in submersibles by William Beebe and fellow scientist Otis Barton, who used a submersible sphere (a crude steel sphere on the end of a long cable) to make record dives in the 1930s and 1940s. Corfield also recounts the subsequent development and deployment of the bathyscaphe *Trieste* (a self-propelled deep-sea diving submersible with a crew of two), in which Don Walsh and Jacques Piccard dove to deepest part of the Marianas Trench, Challenger Deep, in 1960 achieving the record depth of 35,700 feet (this was about 10,000 feet deeper than the area in the Marianas Islands the *Challenger* had measured).

As mentioned earlier, a critical goal of the expedition was to achieve a better understanding of the nature of bottom sediments. At debate was whether the vast blankets of calcareous sediments are native to the ocean floor or formed from the organic detritus left behind as shell-secreting animals on the surface died and drifted slowly to the abyssal depths. *Challenger* found evidence to support the latter theory, and its crew extensively catalogued the various species of foraminifera (tiny animals [some as small as a grain of sand] with a calcium carbonate shell) that serve as the main component of *Globigerina* ooze (the soft, chalky mud generally found at depths below 3,000 feet). This study of bottom sediments serves as a point of departure for discussing the ability of biogenic sediments to represent Earth's geologic history and the history of climate change. Corfield relates the subsequent inquiries that ultimately led to the CLIMAP (Climate: Long-range Investigation, Mapping, and Prediction) project in the early 1970s.

Challenger's transit of the Bermuda Triangle leads to a long discussion on the folklore and natural history of that mythologized

region. This is followed by a lively discussion of the mysterious deep ocean methane hydrate deposits found in the northern part of the Triangle, their possible role in climate change, and their potential as an energy source.

Nested in the narrative are such disparate topics as the nature of Sargasso Sea kelp, oceanic bioluminescence, underwater volcanic vents, submerged manganese nodule fields, the calcite compensation depth, and the Mohorovicic discontinuity (the boundary between the crust and mantle).

At times, the sidebar stories are barely related to the narrative, but they are always engaging. For example, *Challenger's* visit to Cape Town leads to a spirited recounting of the history and geology of the South African diamond mines, and the expedition's aborted approach to Antarctica inspires a discussion on the nature of the ice cap found on Europa (one of Jupiter's four moons).

The result of all these intellectual peregrinations is a book that not only recounts the history of this remarkable expedition but also informs the reader of some of the peculiarities of the geology and natural history of the oceans, as well as the history of modern ocean discovery.

The Silent Landscape is not meant to be a scholarly text, but rather an engaging collection of essays about the nature of the world's oceans, written for the general reader. By tying these essays to the narrative history of the *Challenger* expedition, the author places the expedition in the context of 20th Century ocean discovery while crafting a book that is both informative and entertaining.

As a practicing scientist and researcher, Corfield has worked extensively investigating the influence of climate change on the geologic record and on the evolution of oceanic micro-plankton. In *The Silent Landscape*, however, he focuses on communicating the fun and mystery of science to the non-scientific public. ■