The Voyage of the "Challenger"

From 1872 to 1876 a doughty little ship sailed the seven seas and gathered an unprecedented amount of information about them, thereby founding the science of oceanography

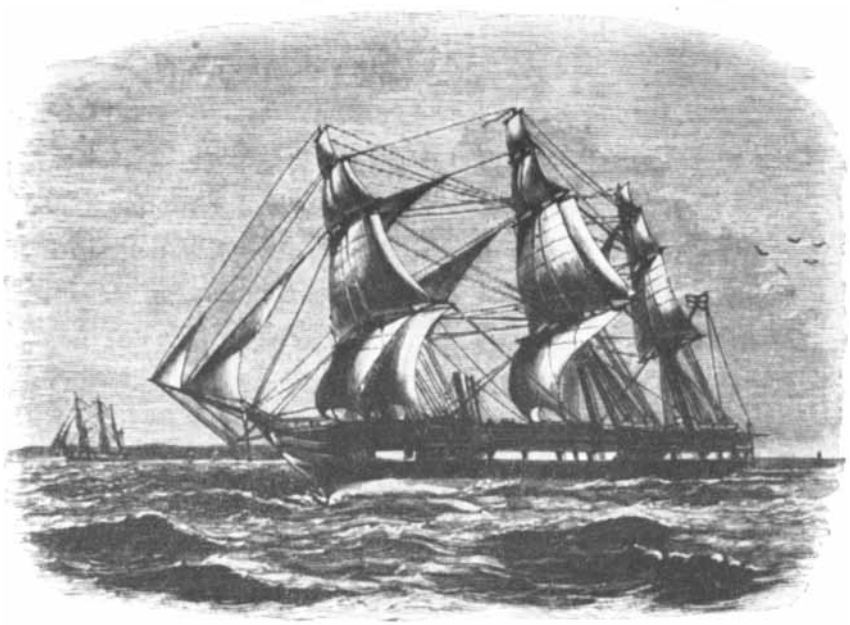
by Herbert S. Bailey, Jr.

JUST 77 years ago this month a spar-decked little ship of 2,300 tons sailed into the harbor of Spithead, England. She was home from a voyage of three and a half years and 68,890 miles over the seven seas. Her expedition had been a bold attack upon the unknown in the tradition of the great sea explorations of the 15th and 16th centuries. The unknown she had explored was the sea bottom. When she had left England, the ocean deeps were an almost unfathomed mystery. When she returned, she had sounded the depths of every ocean except the Arctic and laid the foundation for the modern science of oceanography.

The ship was called the *Challenger*. Her name and voyage are already covered with the dust of time, but her story is worth reviving today, when far more handsomely outfitted expeditions are once more exploring the sea deeps. They are filling in details and retouching parts of a picture which in its broad outlines has remained essentially unchanged since that pioneering voyage. It was the *Challenger*, rigged with crude but ingenious sounding equipment, that charted what is still our basic map of the world under the oceans.

Before the *Challenger*, only a few isolated soundings had been taken in the deep seas. Magellan is believed to have made the first. During his voyage around the globe in 1521 he lowered hand lines to a depth of perhaps 200 fathoms (1,200 feet) in the Pacific; failing to reach bottom, he concluded that he was over the deepest part of the ocean. (Actually the water where he took his soundings is 12,000 feet deep, far from the deepest bottom in the Pacific.) After Magellan no deep-sea soundings were taken for about 300 years. In the 19th century a few sea captains and layers of telegraph cables began to plumb deep waters, some of them getting their lines down as deep as two miles or more.

One of the first men to take a scientific interest in the ocean depths was Edward Forbes, professor of natural philosophy at the University of Edinburgh. He did some dredging in the Aegean Sea, studying the distribution of flora and fauna and their relation to depths, temperatures and other factors. Forbes never dredged deeper than about 1,200 feet, and he acquired some curious notions, including a belief that nothing lived in the sea below 1,500 feet. But his pioneering work led the way for the *Challenger* expedition.

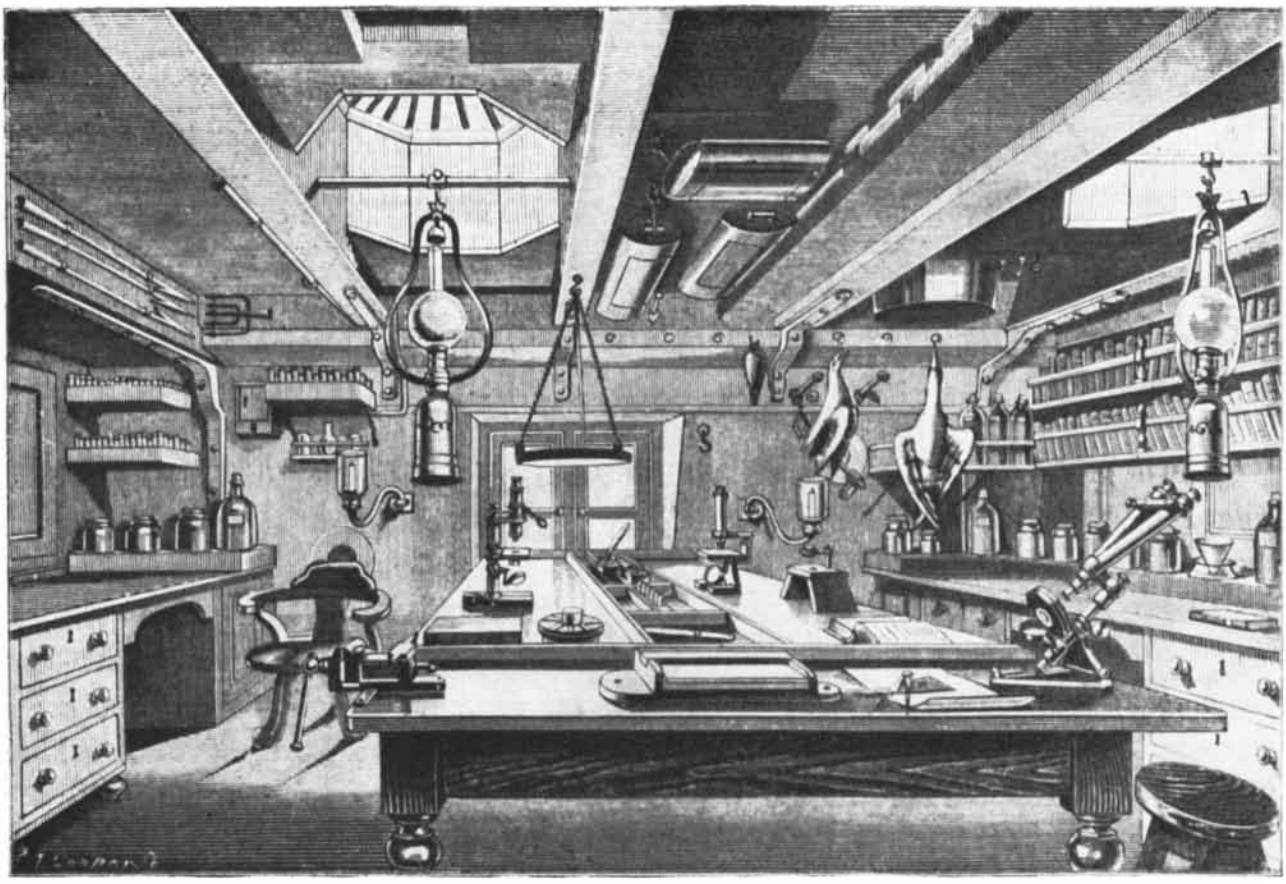


H.M.S. Challenger, *as depicted in the official* Challenger *report*

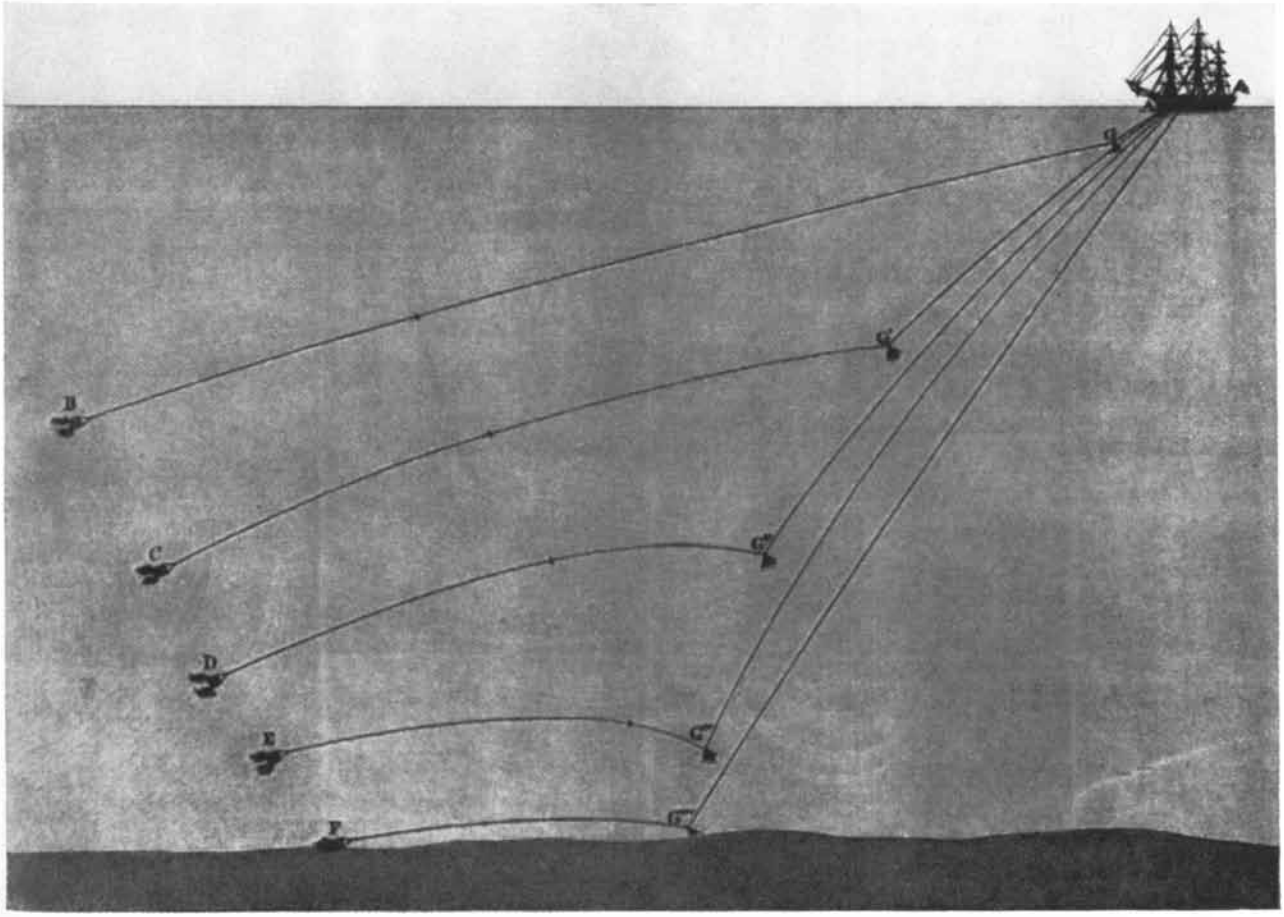
THE MAN WHO organized the expedition was Charles Wyville Thomson, Forbes's successor as professor of natural philosophy at Edinburgh. Thomson first made some summer dredging cruises in ships borrowed from the British Admiralty, and the results were so interesting that they prompted Thomson and the Royal Society to approach the Admiralty with a much more ambitious project. They asked for a vessel that could carry out an investigation of the "conditions of the Deep Sea throughout all the Great Oceanic Basins." The naval authorities, now fully awake to the importance of oceanic research, provided H.M.S. *Challenger*, a corvette fitted with auxiliary steam power in addition to her sails. A naval crew under Captain George S. Nares was assigned to the mission, and Thomson selected a staff of scientists and other civilians to assist him.

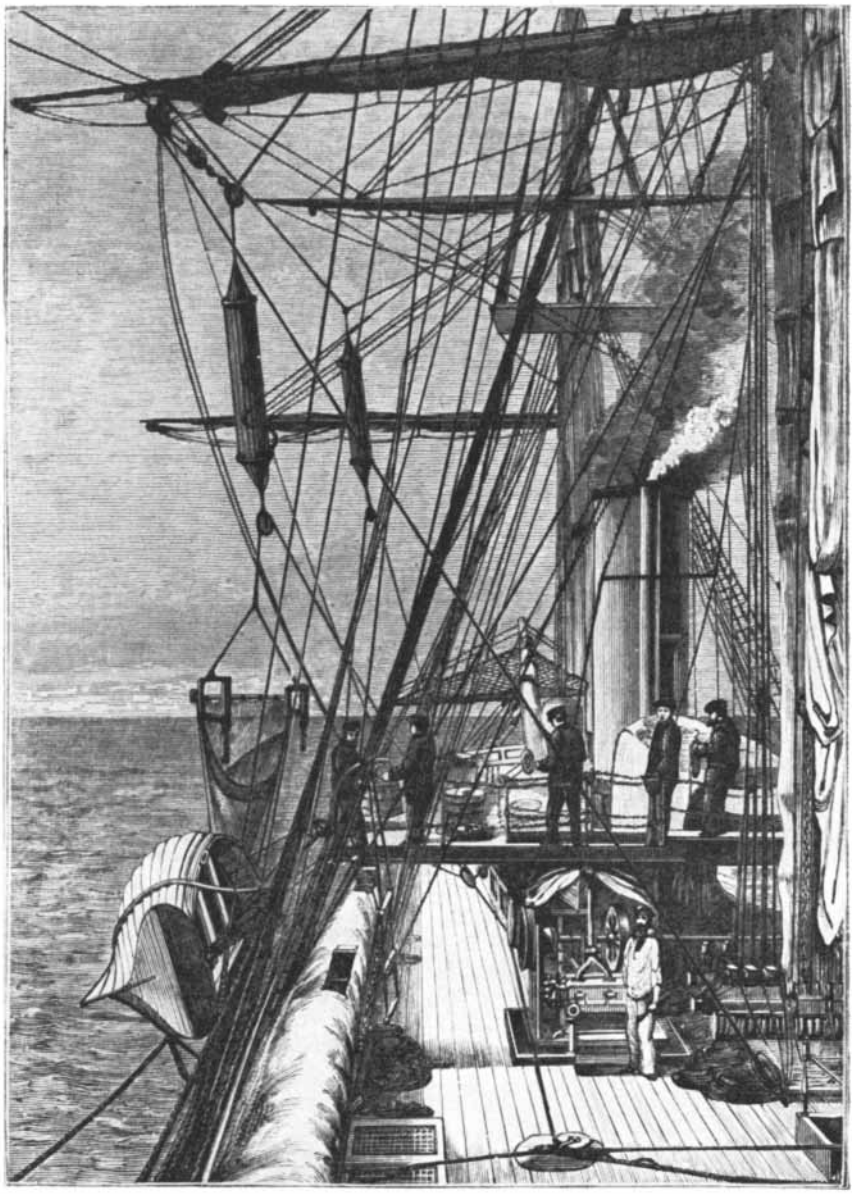
They proceeded to adapt or improvise the necessary scientific equipment and to fit out laboratories on the ship. To make room for their gear they removed all but two of the warship's 18 guns. Their equipment included instruments for taking soundings, bottom samples and undersea temperatures; winches and a donkey engine; 144 miles of sounding rope and 12.5 miles of sounding wire; sinkers, nets, dredges, a small library, hundreds of miscellaneous scientific instruments and "spirits of wine" for preserving specimens.

The expedition, coming after Charles Darwin's famous voyage in the *Beagle* and in the midst of the great uproar over his new theory of evolution, naturally attracted public attention. Even



The zoological laboratory of the Challenger (above), *and the principle of its deep-sea dredges* (below)





Dredging and sounding apparatus on the deck of the Challenger

Punch gave the *Challenger* a send-off:

Her task's to sound Ocean, smooth humours or rough in,
To examine old Nep's deep-sea bed. . . .
In a word, all her secrets from Nature to wheedle,
And the great freight of facts homeward bear.

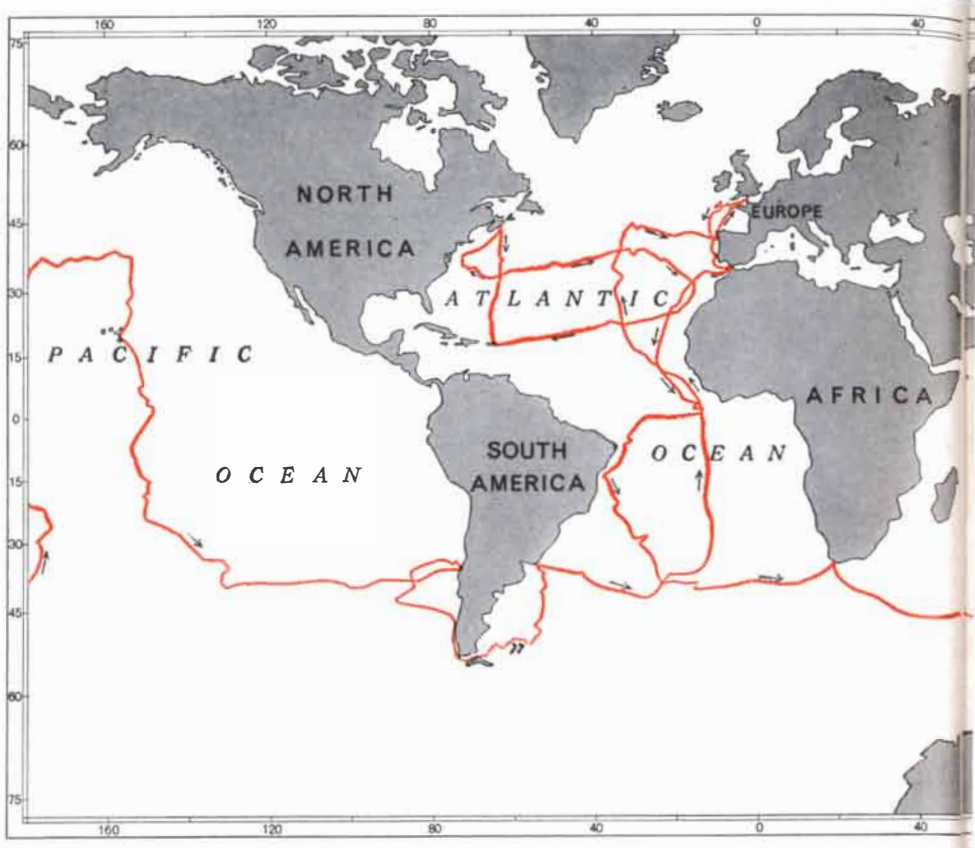
The *Challenger* sailed from Portsmouth on December 21, 1872. She immediately ran into a howling storm at sea. Thomson found this no evil omen, pointing out that the gale "brought all our weak points to light" and increased confidence in the arrangements. His staff spent the first leg of the voyage, as far as Bermuda, in training and practice on their work: sounding, dredging, trawling and making measurements. Holding the ship steady with her steam engines, the civil and naval crews each time took a standard series of observations: the total depth of water, the temperatures at various depths, the atmospheric and meteorological conditions, the direction and rate of the current on the ocean surface and occasionally of the currents at different depths. They also dredged up samples of the bottom, including its plant and animal life, and dipped up samples of the water and of the sea life at various levels. They found they had to make their soundings with the hemp rope, because the wire tended to kink and break. Attached to the line were sinkers, thermometers and water bottles; when the sinkers hit the bottom they were automatically detached. By the time they had finished their voyage, they had made such observations at 360 stations scattered over the 140 million square miles of the ocean floor.

The routine was long and laborious. In really deep water it took more than an hour and a half to reach bottom—and much longer to haul the line back. "Dredging," wrote one of the naval officers, "was our *bête noire*. The romance of deep-water trawling or dredging in the *Challenger*, when repeated several hundred times, was regarded from two points of view: the one was the naval officer's, who had to stand for 10 or 12 hours at a stretch carrying on the work . . . the other was the naturalist's . . . to whom some new worm, coral, or echinoderm is a joy forever, who retires to a comfortable cabin to describe with enthusiasm this new animal, which we, without much enthusiasm, and with much weariness of spirit, to the rumbling tune of the donkey engine only, had dragged up for him from the bottom of the sea."

THE TRIP was not, however, all drudgery. There was romance and adventure enough to inspire the officers and scientists, almost to a man, to produce memoirs, logs and other accounts for an eagerly waiting public at the end of the voyage. One of the first diversions occurred in the South Atlantic. Putting in at the tiny colony of Tristan Island, the *Challenger*'s crew learned from the inhabitants that two brothers named Stoltenhoff, seeking their fortune at sealhunting, had marooned themselves nearly two years earlier on aptly named Inaccessible Island. The ship diverted its course to rescue the brothers. They had kept themselves alive on a diet of penguins' eggs and wild pigs, but had had no luck catching seals. The ship also stopped at nearby Nightingale Island, a rookery for hundreds of thousands of penguins, and found it so covered with eggs that the shore party could hardly walk without stepping on them. The penguins defended their nests furiously and pecked one of the ship's dogs to death.

Beyond Cape Horn, on Marion Island, they saw multitudes of white albatross, but, heeding the warning of the Ancient Mariner, they killed none. This was a rare exception, for it was their practice to collect specimens of indigenous flora and fauna wherever they touched land.

Exploring in the southernmost Indian Ocean, the *Challenger* became the first steamship to cross the Antarctic Circle. The scientists were tremendously interested in the icebergs and even fired a cannon at one to break off a chunk. In an unsuccessful attempt to find the "Termination Land" reported by the U. S. explorer Charles Wilkes, the *Challenger* ran into a sudden antarctic storm while traversing a pack of icebergs. With the wind at 42 miles per hour and night coming on, the ship took refuge in the lee of a large berg, holding position close beside it with the steam engine. During an unexpected lull in the wind,



A general outline of the voyage of the

the ship rammed the berg before the engine could be reversed and lost its jib boom and other rigging. The damage was not serious and the rigging was recovered, but the company spent an anxious night steaming back and forth in a dense snowstorm between two large icebergs.

The ship next went on to Australia, New Zealand and the Pacific islands. In the Fijis they interviewed King Thackombau, a converted Christian, who had earlier cut out a prisoner's tongue and eaten it in his sight—before eating the prisoner himself. The ship called at the Philippines, Japan, China and the Admiralties. On March 23, 1875, off the Marianas Islands, the explorers hit their deepest sounding—26,850 feet. This was not very far from the deepest of all time: the record to date is a sounding of 34,440 feet, made in the Mindanao Trench off the Philippines by a U. S. Navy vessel in 1950.

The *Challenger* zigzagged across the Pacific, stopping at the Hawaiian Islands and Tahiti, and then rounded South America through the Strait of Magellan. It swung north through the South and North Atlantic and finally arrived home in England on May 24, 1876.

Of the *Challenger*'s crew of some 240 men, seven died during the trip: two by

Cladodactyla crocea, *taken in the Falkland Islands*

lenger

drowning, one of yellow fever, the others of accidents and miscellaneous causes. Several of the crew jumped ship in Australia. The remainder returned to a joyful welcome—and to the long, hard task of organizing the vast amount of data accumulated on the voyage.

A COMMISSION was set up in Edinburgh to assess the results of the voyage, which were eventually published in an official report of 50 volumes. Two volumes contain a "summary of scientific results"; two a "narrative of the voyage." The other 46 are monographs written by some of the leading scientists of the day, among them T. H. Huxley,

Japetella prismatica

Alexander Agassiz, H. N. Moseley and the great German biologist Ernst Haeckel. Most famous of the official reports are Haeckel's monographs on certain sea organisms that had previously been relatively little known. One of the most interesting is on the radiolaria, of which the expedition collected 3,508 new species to add to the 600 then known.

To see the *Challenger*'s scientific results in proper perspective one must remember that the voyage took place at a time when every new discovery was an exciting prize to be fitted into the evolutionary table. The *Challenger* discovered 715 new genera and 4,417 species of living things, thus demonstrating that the oceans were teeming with unknown life waiting to be classified. It proved beyond question that life existed at great depths in the sea. The voyage opened the great descriptive era of oceanography, which was followed by the analytic oceanography of our own century.

The summary volumes were written by Sir John Murray, who became head of the commission after Thomson, exhausted by the voyage, died in 1882. Murray's comments and theories have had an important influence on oceanography. He strongly put forward the view, for example, that at equivalent latitudes both the Arctic and the Antarctic have similar marine organisms, and that these are not to be found in the more temperate zones. This "bipolarity" theory has now been discarded, but for a time it stimulated much investigation. Murray also asserted that, contrary to what had been hoped and expected, the deep sea did not yield a widespread fauna of great antiquity, though some very ancient species were found. He believed that under about 600 feet below sea level the bottom deposits and fauna become more uniform with increasing depth until a point is reached at which conditions are almost the same in all parts of the world. He added, "When once animals have accommodated themselves to deep-sea conditions there are few barriers to further vertical or horizontal migration." Such suggestions, based on the *Challenger*'s observations, gave direction to further investigation.

The expedition washed out of existence a form of living matter that had been "observed" by Huxley and described by Haeckel. On the basis of preserved specimens dredged during earlier expeditions, Haeckel had decided that the entire ocean floor, or at least a major part of it, was covered with a thin layer of almost structureless living slime which he named "Bathybius." At a time when Darwin's theories were still under severe debate, "Bathybius" had been hailed as a living example of the primordial protoplasm. The scientists of the *Challenger* looked for it in vain, and finally discovered the answer to the puzzle. The alcohol and sea water in which the sea-bottom specimens were preserved had combined to form an amorphous precipitate of sulfate of lime. This was Haeckel's "Bathybius."

THE *Challenger* expedition made thousands of other contributions to various sciences—meteorology, hydrography, the physics and chemistry of sea water, geology, petrology, botany, zoology, geography. Murray's map of the world-wide sampling of oozes and other bottom deposits collected by the expedition has not been changed much by the many subsequent explorations. The *Challenger*'s crew perfected the method of "swinging the compass" to get accurate magnetic readings. The voyage established the main contour lines of the ocean basins and disproved the myth of the lost continent Atlantis. It yielded the first systematic plot of currents and temperatures in the oceans, and showed that the temperature in each zone was fairly constant in all seasons.

The achievement of the *Challenger* was tremendous: a barrier had been broken and the world of the depths explored. In a sense the *Challenger* had answered the question that had echoed down the ages in the words of Ecclesiastes: "That which is far off and exceeding deep, who can find it out?"

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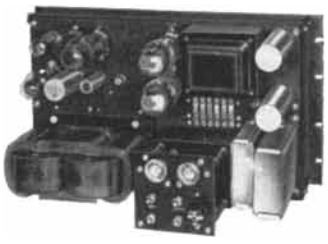

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