

by Captain G. S. Nares, and this expedition was no less interesting or important than those that went before.

The chemical and physical work of the "Porcupine" expeditions was not so satisfactory as might be wished. Marine chemistry was so entirely new, that a great deal of preliminary work had to be done in order to gain the experience necessary for further more accurate experiments. Indeed, it was in the way of suggesting improvements for future use that the chemical work of the "Porcupine" was most valuable. Frémy in 1837,¹ Morren in 1843,² and Lewy in 1846, had previously analysed the gases of sea-water, but these were not more successful than those of the "Porcupine." A great advance was, however, made by Jacobsen during the expedition of the "Pommerania" in the North Sea in 1872. He introduced the slip water bottle for collecting deep water, and devised an ingenious modification of Bunsen's method for collecting the gases, which left little to be desired, and was afterwards used on the Challenger and other expeditions.³

In December of 1871 and early in 1872 the U.S. Coast Survey Steamer "Hassler," under the scientific direction of Professor Louis Agassiz, dredged in considerable depths off the coast of South America, but with no striking results. Before starting on this expedition Agassiz left in the hands of Professor Pierce a very remarkable document,⁴ in which, from various considerations, he ventures "to foretell what we are likely to find in the deepest abysses of the sea, from which thus far nothing has been secured." Among the organisms he expected to discover are mentioned representatives of Ganoids, of Cestraciontes or Hybodontes among Selachians, as well as representatives of other extinct types.

F. THE EXPLORATIONS OF THE CHALLENGER AND SUBSEQUENT EXPEDITIONS.

The cruises of the "Porcupine," together with preceding and contemporary expeditions, had clearly established that organisms lived at vast depths in the ocean, that with the proper appliances these deep-sea organisms could be satisfactorily investigated, and that the physical and chemical conditions obtaining in deep water and on the floor of the ocean, even in adjoining areas, were by no means constant and uniform. The efforts of the previous decade had been directed to the strips of water along the coasts, or to enclosed or partially enclosed seas; the vast ocean basins lay scientifically unexplored. This consideration led to the conception of a great exploring expedition, which should circumnavigate the globe, sound the most profound abysses, and investigate the physical, chemical, and biological conditions of the great oceans with all the methods and apparatus suggested by preceding researches. On the receipt of representations from the Royal Society and other learned bodies, the British Government undertook to fit out such an

¹ *Comptes Rendus*, tom. vi. p. 616, 1838.

³ See Narr. Chall. Exp., vol. i. p. 16.

² *Ann. chim. et phys.*, ser. 3, tom. xii. p. 5.

Bull. Mus. Comp. Zoöl., vol. iii. pp. 49-53, 1872.