

atmospheric gases. From the researches conducted during the voyage of the "Bonité" in the Atlantic and Indian Oceans, it was estimated that the gases in 100 volumes of sea-water ranged from 1.85 to 3.04, or from two to three per cent. From observations made during the "Porcupine" cruise of 1868, it was ascertained that the proportion of oxygen was greatest in the surface water, and least in the bottom water. The dissolved oxygen and nitrogen are doubtless absorbed from the atmosphere, the proportion so absorbed being mainly regulated by temperature. According to Dittmar's recent determinations, a litre of sea-water at 0° C. will take up 15.60 cubic centimetres of nitrogen and 8.18 of oxygen, while at 30° C. the proportions sink respectively to 8.36 and 4.17. He regards the carbonic acid as occurring chiefly as carbonates, its presence in the free state being exceptional. During the voyage of the "Challenger," Buchanan ascertained that the proportion of carbonic acid is always nearly the same for similar temperatures, the amount in the Atlantic surface water, between 20° and 25° C., being 0.0466 gramme per litre, and in the surface Pacific water 0.0268; and that sea-water contains sometimes at least thirty times as much carbonic acid as an equal bulk of fresh water would do.¹⁸ A supposed greater proportion of carbonic acid in the deeper and colder waters of the ocean has been suggested as the main cause of the disappearance of the larger and more delicate calcareous pelagic organisms from abysmal deposits, these forms being more readily attacked and carried away in

¹⁸ Proc. Roy. Soc. xxiv. According to Mr. Tornøe (Norwegian North-Atlantic Expedition, 1876-78, "Chemistry") most of the carbonic acid of sea-water is in combination with soda as bicarbonate of soda. See his memoir for an estimate of the proportion of air in sea-water; also J. Y. Buchanan, *Nature*, xxv. p. 386. Dittmar, *op. cit.* p. 209.