

the surface. This bottle appeared to answer fairly, and we often had evidence, from its turbidity, that bottom-water came up; but subsequent experiments have shown that it cannot be depended upon, and some of the reasons are sufficiently obvious. The instrument will not work at all unless the descending motion be sufficiently steady and rapid to maintain a current capable of keeping two heavy brass valves open to their full extent; if there be the slightest reversal, or jerk, or irregularity in hauling up, the water is—at all events partially—changed; the two valves, even when thoroughly open, are directly in the path of the ingress and egress of the water—and there is reason to believe that the water is not so rapidly and thoroughly changed as we at first imagined. A perfectly satisfactory water-bottle is still a desideratum, but I believe that one which was used by Dr. Mayer and Dr. Jacobsen in the German North Sea expedition of the past summer, goes far to remedy most of these defects. I hope we may be in a better position to give an opinion a year hence.

I give, in the appendix to this chapter, an abstract of the general results of the chemical investigations carried on during the 'Porcupine' cruises of 1869; and I add a note, for which I am indebted to my friend Mr. J. Y. Buchanan, who accompanies me as chemist to the 'Challenger' expedition, which will show how much has yet to be done before we can hope to come to any really satisfactory conclusion as to the amount and condition of the gases contained in sea-water. Neither, I regret to say, can we place much reliance on the determination of