

which will be quoted liberally. With reference to the composition of the salt mixture dissolved in sea water, Professor Dittmar says :—

“ *A priori*, we should say that this composition cannot be subject to any great variation; because, if there were no chemical changes going on in the ocean, and no gain or loss of dissolved individual salts, this composition would now, after thousands of years' constant intermixture, be absolutely the same everywhere; and what is going on in the shape of reactions and importation or exportation of individual salts, really amounts only to an extremely minute fraction of the whole, even in the course of a century. This conclusion is confirmed by the analyses of several hundred samples of surface waters, which were carried out by Forchhammer in connection with a great research which he published in 1864.¹ According to his results, if we confine ourselves to the open ocean, we find that everywhere the ratios to one another of the quantities of chlorine, sulphuric acid, lime, magnesia, and total salts exhibit practically constant values. With the view chiefly of supplementing Forchhammer's work, I have made exact determinations of the chlorine, sulphuric acid, lime, magnesia, potash, and soda in 77 samples of water collected by the Challenger from very different parts of the ocean :—

12 from the surface.

10 from depths of 25 to 100 fathoms.

21 from depths of over 100 to 1000 fathoms.

34 from greater depths.

“ The results, while fairly agreeing with Forchhammer's, were in still closer accordance with one another, and thus showed that Forchhammer's proposition may be extended from surface waters to ocean waters obtained from all depths.

“ The solid matter dissolved in sea water, though strictly speaking, and we may add necessarily, of a very complex composition, consists substantially of the muriates and sulphates of soda, magnesia, lime, and potash. Forchhammer, after having satisfied himself that all the other constituents taken conjointly amount to only a small fraction of one per cent. of the total solids, in his individual analyses limited himself to exact determinations of the chlorine, sulphuric acid, lime, and magnesia. The potash he determined only in a comparatively small number of samples; and where he reports the soda this component is calculated by difference, on the assumption that the acids and bases present exactly neutralise each other. But this assumption had never been proved to be correct, and *à priori* is improbable, because it leaves out of reckoning the carbonate of lime which many animals need for forming their shells. I therefore in my analyses made it a special point, in addition to the other bases, to determine also the soda by a method independent of the assumption quoted; and on calculating my first set of (21)

¹ *Phil. Trans.*, vol. clv. p. 203, 1865.