

vation also provides a striking example of the efficiency with which the reaction of sea water is maintained. In spite of the unusual circumstances here the variation is inconsiderable. The only known important factor which operates to establish and to preserve the reaction of sea water is the carbonate equilibrium.

There is one consideration which must be especially noted before passing on. The most obvious effect of slight changes of temperature, and of slight changes of alkalinity as well, is upon the velocity of chemical reactions. In this respect the effect of hydroxyl ions is likely to be in proportion to their concentration,<sup>1</sup> and the effect of temperature is usually such that a change of about ten degrees doubles the velocity of the reaction.<sup>2</sup> Hence ordinary chemical reactions will progress about eight times as fast in the hottest as in the coldest ocean waters, and about seven times as fast in the most alkaline as in the least alkaline parts of the ocean. But in the case of any organism inhabiting a particular locality such changes in reaction velocity will be scarcely

<sup>1</sup> The chief actions of hydroxyl ions are catalytic, and, as in the case of the catalysis of esterification, the effect is proportional to the concentration of the hydroxyl ions.

<sup>2</sup> This observation is due to van't Hoff.