

of sea-water surcharged with lime. This lime, though in a metastable condition, finds no nuclei to deposit upon and remains in solution, being carried about until it reaches an area impoverished of lime by precipitation, when its condition becomes stable, or until it is itself reprecipitated by coming into the sphere of action of an ammonia-producing organism. Thus the ocean as a whole remains just about saturated for calcium carbonate.

Oceanic calcium undergoes extensive circulation between the dissolved and undissolved states. When calcareous fragments fall on a clayey or muddy bottom, they fall into water which can take up lime, and are dissolved as the water passes over them, while on falling on distinctively calcareous deposits like Pteropod ooze they fall into water-layers, immediately above the bottom, which can dissolve no more lime. In either case the lime depends for its redistribution on the slow processes of diffusion by convection and other currents. In those areas covered by Globigerina and Pteropod oozes lime is being steadily withdrawn from the ocean. Over Red clay areas, on the other hand, lime is being returned to the ocean. From the state of saturation of sea-water we may infer that the aggregate accessions of lime to the bottom exactly balance the aggregate supply from land and from the direct decomposition of submarine rocks. On the whole, lime at the present time appears to be accumulating towards the equator.

Magnesium
carbonate.

Another element present in the sea, magnesium, shares the vicissitudes of calcium, but in a very minor degree. Magnesium, in contrast with calcium, is very prone to form hydrated and basic carbonates, and when the carbonate is precipitated from solutions of magnesium salts, it comes down not in the anhydrous crystalline form, but mainly as a trihydrate. Now solubility-determinations in pure water and in salt-solutions indicate that $MgCO_3$ as bicarbonate, in equilibrium with trihydrate, is of the order of ten times more soluble than $CaCO_3$. Hence the former is far less likely to be precipitated than the latter, even though there is about three times as much magnesium in the sea as calcium. Moreover, it is well known that magnesium carbonate is not readily brought down in presence of ammonia. Thus we find that in living shells, corals, and algæ the proportion of $MgCO_3$ to $CaCO_3$ is usually below 1 per cent. It is observed, however, that in dead carbonates, *e.g.* Coral sands and muds and calcareous oozes which have been for a long time at the bottom, there are markedly greater admixtures of magnesium.