

other organisms, are composed fundamentally of chitin,¹² a transparent horny substance which can long resist decomposition. In the vegetable kingdom, the substance known as cellulose forms the essential part of the framework of plants. In dry air, it possesses considerable durability, also when thoroughly waterlogged and excluded from meteoric influences. In the latter condition, imbedded amid mud or sand, it may last until gradually petrified.¹³

It is a familiar fact that in the same stratum different organisms occur in remarkably different states of conservation. This is sometimes strikingly exemplified among the mollusca. The conditions for their preservation may have been the same, yet some kinds of shells are found only as empty molds or casts, while others still retain their form, composition, and structure. This discrepancy, no doubt, points to original differences of composition or structure. The aragonite shells of a stratum may be entirely dissolved, while those of calcite may remain.¹⁴ The presence, therefore, of calcite forms only does not necessarily imply that others of aragonite were not originally present. But the conditions of petrification have likewise greatly varied. In the clays of the Mesozoic formations, for example, cephalopods may be exhumed retaining even their pearly nacre, while in corresponding deposits among the Palæozoic systems they are merely crystalline calcite casts.

2. Fossilization.—The condition in which organic remains have been entombed and mineralized may be reduced to three leading types.

(1) *The original substance is partly or wholly preserved.*—Several grades may be noticed: (a) where the entire animal substance is retained, as in the frozen carcasses of mammoths in the Siberian cliffs; (b) where the organism has been mummified by being incased in resin or gum (insects in amber); (c) where the organism has been carbonized with or without retention of its structure, as is characteristically shown in peat, lignite, and coal; (d) where a variable por-

¹² According to C. Schmidt, the composition of this substance is C, 46.64; H, 6.60; N, 6.66; O, 40.20. The brown chitin of Scottish Carboniferous scorpions is hardly distinguishable from that of recent species.

¹³ On cellulose and coal, see C. F. Cross and E. J. Bevan, *Brit. Assoc.* 1881, Sects. p. 603.

¹⁴ See ante, pp. 216, 243, and authorities there cited.