

distribution of organized beings. "The causes which led to a complete change of life three times during the deposition of the freshwater and brackish strata must," says this naturalist, "be sought for, not simply in either a rapid or a sudden change of their area into land or sea, but in the great lapse of time which intervened between the epochs of deposition at certain periods during their formation."

Each dirt-bed may, no doubt, be the memorial of many thousand years or centuries, because we find that 2 or 3 feet of vegetable soil is the only monument which many a tropical forest has left of its existence ever since the ground on which it now stands was first covered with its shade. Yet, even if we imagine the fossil soils of the Lower Purbeck to represent as many ages, we need not expect on that account to find them constituting the lines of separation between successive strata characterized by different zoological types. The preservation of a layer of vegetable soil, when in the act of being submerged, must be regarded as a rare exception to a general rule. It is of so perishable a nature, that it must usually be carried away by the denuding waves or currents of the sea or by a river; and many Purbeck dirt-beds were probably formed in succession, and annihilated, besides those few which now remain.

The plants of the Purbeck beds, so far as our knowledge extends at present, consist chiefly of Ferns, Coniferæ (fig. 344), and Cycadææ (fig. 340), without any exogens; the whole more allied to the Oolitic than to the Cretaceous vegetation. The vertebrate and invertebrate animals indicate, like the plants, a somewhat nearer relationship to the Oolitic than to the cretaceous period. Mr. Brodie has found the remains of beetles and several insects of the homopterous and trichopterous orders, some of which now live on plants, while others are of such forms as hover over the surface of our present rivers.

Fig. 344.



Cone of a pine from the Isle of Purbeck (Filton).

*Portland Stone and Sand* (b, Tab. p. 291).—The Portland stone has already been mentioned as forming in Dorsetshire the foundation on which the freshwater limestone of the Lower Purbeck reposes (see p. 296). It supplies the well-known building-stone of which St. Paul's and so many of the principal edifices of London are constructed. This upper member rests on a dense bed of sand, called the Portland sand, containing for the most part similar marine fossils, below which is the Kimmeridge clay. In England these Upper Oolite formations are almost wholly confined to the southern counties. Corals are rare in them, although one species is found plentifully at Tisbury, Wiltshire, in the Portland sand, converted into flint and chert, the original calcareous matter being replaced by silex (fig. 345).

The *Kimmeridge clay* consists, in great part, of a bituminous shale, sometimes forming an impure coal, several hundred feet in thickness. In some places in Wiltshire it much resembles peat; and the bituminous