tion of the original substance, and especially the organic matter, has been removed, as happens with shells and bones: this is no doubt one of the first steps toward petrifaction.

(2) *The original substance is entirely removed, with retention merely of external form.*—Mineral matter gathers round the organism and hardens there, while the organism itself decays. Eventually a mere mold of the plant or animal is left in stone. Every stage in this process may be studied along the margin of calcareous springs and streams (ante, p. 808). The lime in solution is precipitated round fibres of moss, leaves, twigs, etc., which are thereby incrusted with mineral matter. While the crust thickens, the organism inside decays, until a mere hollow mold of its form remains. Among stratified rocks, molds of organic forms are of frequent occurrence. They may be filled up with mineral matter, washed in mechanically or deposited as a chemical precipitate, so that a cast in stone replaces the original organism. Such casts are particularly common in sandstone, which, being a porous rock, has allowed water to filter through it and remove the substance of inclosed plant-stems, shells, etc. In the sandstones of the Carboniferous system, casts in compacted sand of stems of *Lepidodendron* and other plants are abundant. It is obvious that in casts of this kind no trace remains of the original structure of the organism, but merely of its external form.

(3) *The original substance is molecularly replaced by mineral matter with partial or entire preservation of the internal structure of the organism.*—This is the only true petrifaction. The process consists in the abstraction of the organic substances, molecule by molecule, and in their replacement by precipitated mineral matter. So gradual and thorough has this interchange often been, that the minutest structures of plant and animal have been perfectly preserved. Silicified wood is a familiar example (see p. 619).

The chief substance which has replaced organic forms in rocks is calcite, either crystalline or in an amorphous granular condition. In assuming a crystalline (or fibrous) form, this mineral has often observed a symmetrical grouping of its component individuals, these being usually placed with their long axes perpendicular to the surface of an organism. In many cases, among invertebrate remains, the calcite now visible is pseudomorphous after aragonite (p. 216). Next in abundance as a petrifying medium is silica, most commonly in the chalcedonic form, but also as quartz. It is specially frequent in some limestones, as chert and