

that a temperate climate in the arctic regions has throughout geological time been the rule rather than the exception.

### III.—MINERALISATION OF FOSSIL PLANTS.

THE state of preservation of fossil plants has been referred to incidentally in several places in the text; but the following more definite statements may be of service to the reader.

I. Organic remains imbedded in aqueous deposits may occur in an unchanged condition, or only more or less altered by decay. This is often the case with such enduring substances as bark and wood, and even with leaves, which appear as thin carbonaceous films when the layers containing them are split open. In the more recent deposits such remains occur little modified, or perhaps only slightly changed by partial decay of their more perishable parts. In the older formations, however, they are usually found in a more or less altered condition, in which their original substance has been wholly or in part changed into coaly, or bituminous, or anthracitic or graphitic matter, so that leaves are sometimes represented by stains of graphite, as if drawn on stone with a lead-pencil. Yet even in this case some portion of the original substance remains, and without any introduction of foreign material.

II. On the other hand, such remains are often mineralised by the filling of their pores or the replacement of their tissues with mineral matter, so that they become hard and stony, and sometimes retain little or nothing of their original substance. The more important of these changes, in so far as they affect fossil plants, may be arranged under the following heads:

(a) *Infiltration* of mineral matter which has penetrated the pores of the fossil in a state of solution. Thus the pores of fossil wood are often filled with calcite, quartz, oxide of iron, or sulphide of iron, while the woody walls of the cells and vessels remain in a carbonised state, or converted into coaly matter. When wood is preserved in this way it has a hard and stony aspect; but we can sometimes dissolve away the mineral matter, and restore the vegetable tissue to a condition resembling that before mineralisation. This is especially the case when calcite is the mineralising substance. We sometimes find, on microscopic examination, that even cavities so small as those of vegetable cells and vessels have been filled with successive coats of different kinds of mineral matter.

(b) Organic matters may be entirely *replaced* by mineral substances. In this case the cavities and pores have been first filled,