

glacial period is no doubt somewhat exaggerated by those geologists who imagine our continents to have been covered with a continuous ice-sheet of amazing thickness. Some portion of the marvellousness of the preceding warmth is also removed by the consideration of the local inequalities at present observed in the northern regions, as, for instance, between the comparatively temperate climate of Norway and Sweden and the perpetual ice of Greenland in the same latitude. Making all possible allowance for these mitigations, the magnitude of the revolutions actually proved to have occurred remains but little extenuated, while it seems certain that many of the plants and animals still living have continued through all these changes, and have been driven from place to place for safety as climatal revolutions proceeded.

So far we may be satisfied that we have certain knowledge; but when we inquire further as to the actual antiquity of the glacial period, as to its duration and rates of advance and recession, as to its causes, and the relation of these to the remarkable submergences and emergences of the land, we find ourselves lost on a tempestuous sea of rival theories. To some extent these may be matters of indifference to the physical geographer or evolutionary biologist, but he is deeply interested in the questions of time and place, and these can scarcely be settled without reference to the causes and conditions of change.

Mr. Searles V. Wood, in an able summary of the possible causes of the succession of cold and warm climates in the northern hemisphere, enumerates no fewer than seven theories which have met with more or less acceptance, and he might have added an eighth. These are:

(1) The gradual cooling of the earth from a condition of original incandescence.

(2) Changes in the obliquity of the ecliptic.

(3) Changes in the position of the earth's axis of rotation.

(4) The effect of the precession of the equinoxes along with changes of the eccentricity of the earth's orbit.

(5) Variations in the amount of heat given off by the sun.

(6) Differences in the temperature of portions of space passed through by the earth.

(7) Differences in the distribution of land and water in connection with the flow of oceanic currents.