7. *Variations in the density of the earth's atmosphere.* — The atmosphere absorbs and retains heat, and the amount absorbed increases with its density. In early geological time, the earth's atmosphere contained much more carbonic acid and moisture than now, and hence it would have absorbed more of the sun's rays as they passed through it. It has been shown by Tyndall that the absorptive power of carbonic acid, under ordinary atmospheric pressure, is 90 times greater than that of the atmosphere, and that of moisture 30 to 70 times greater for non-luminous heat. Their presence in the atmosphere would hence have greatly increased its power to absorb and retain about the earth the sun's heat. "They would produce little reduction in the amount of luminous sun-heat received, and would be a formidable obstacle to non-luminous heat escaping by radiation from the earth's surface into the cold of star-space" (Haughton, 1880).

The earth's lower plains are warmer than its elevated regions, because of the greater density of the air. The lowest places should thus have the warmest climate; and accordingly the basin of the Dead Sea, 1308 feet below the sea level, has the heat of the torrid zone.

8. *Variations in oceanic currents.* — The effect of the Atlantic tropical current on the Arctic and north Atlantic climates has been elucidated by the calculations of Mr. James Croll. His conclusion, based on the amount of water that passes the Florida Strait (nearly agreeing with the latest estimate), and the temperature of the water, is, that the amount of heat conveyed from the equatorial regions northward in the Atlantic by this stream is equivalent to 77,479,650,000,000,000,000 foot-pounds of energy per day, which is equal to all the heat received by 1,560,935 square miles at the equator, and more heat than is conveyed by all the aerial currents; and that the stoppage or diversion of the current would diminish to this extent the heat of the Arctic seas and north Atlantic.

It has been supposed that the diversion of the Gulf Stream from the north Atlantic may have taken place through the sinking of the region of the Isthmus of Darien; but there is no sufficient evidence that such a diversion has happened since Mesozoic time. A more reasonable hypothesis is that it may have been accomplished by a raising of the sea-bottom nearly to the surface between Scandinavia, Great Britain, Iceland, and Greenland, where the depth now is mostly less than 100 fathoms and nowhere exceeds 1000, and along one tract is not over 500 fathoms. The effect of such a north Atlantic barrier would be to confine the Atlantic tropical current to the north Atlantic, and thereby to increase the temperature and amount of evaporation of that ocean. It would reduce the northern part of the stream to the southeast branch, and might diminish its volume; but, in view of the form of the south Atlantic depression and its position with reference to the north Atlantic, the warm stream could not fail to continue its flow.

Again, the Arctic region may formerly have had its climate moderated by receiving the Pacific tropical current, through a submergence about