

tricity; the earth would then be 8,736,420 miles further from the sun in winter than it is at present. The direct heat of the sun would therefore, during winter, be one-fifth less and during summer one-fifth greater than now. This enormous difference would necessarily affect the climate to a very great extent. Were the winters under these circumstances to occur when the earth was in the perihelion of its orbit, the earth would then be 14,368,200 miles nearer the sun in winter than in summer. In this case the difference between winter and summer in our latitudes would be almost annihilated. But as the winters in the one hemisphere correspond with the summers in the other, it follows that while the one hemisphere would be enduring the greatest extremes of summer heat and winter cold, the other would be enjoying perpetual summer.

"It is quite true that, whatever may be the eccentricity of the earth's orbit, the two hemispheres must receive equal quantities of heat per annum; for proximity to the sun is exactly compensated by the effect of swifter motion. The total amount of heat received from the sun between the two equinoxes is, therefore, the same in both halves of the year, whatever the eccentricity of the earth's orbit may be. For example, whatever extra heat the southern hemisphere may at present receive per day from the sun during its summer months, owing to greater proximity to the sun, is exactly compensated by a corresponding loss arising from the shortness of the season; and, on the other hand, whatever deficiency of heat we in the northern hemisphere may at present have per day during our summer half-year, in consequence of the earth's distance from the sun, is also exactly compensated by a corresponding length of season.

"It is well known, however, that those simple changes in the summer and winter distances would not alone produce a glacial epoch, and that physicists, confining their attention to the purely astronomical effects, were perfectly correct in affirming that no increase of eccentricity of the earth's orbit could account for that epoch. But the important fact was overlooked that, although the glacial epoch could not result directly from an increase of eccentricity, it might nevertheless do so indirectly from physical agents that were brought into operation as a result of an increase of eccentricity. The following is an outline of what these physical agents were, how they were brought into operation, and the way in which they may have led to the glacial epoch.