

round numbers, 21,000 years ; so that in 10,500 years (one half of that time) the conditions will be reversed ; that is, we shall have a winter of 186 days, and a summer of 179 days. Then we shall have for winter the 37 per cent. of the annual heat spread over 186 days, whereas now it is spread over only 179 ; and there must be, in consequence, a lowering of temperature, which, when counted from absolute zero or the temperature of intersellar space, must be quite an appreciable quantity, and one not to be neglected. The maximum difference there can be between winter and summer is about 25 days, and this occurs when the orbit of the earth has its greatest eccentricity, and the line of the equinoxes is perpendicular to the major axis of the earth's orbit we have then the maximum astronomic cause for glaciation.

Another important point which must be taken into consideration is this, that the total amount of heat received upon a hemisphere at any time, and in any geologic age, is practically constant, or nearly so.

Now, as the total annual heat is constant, and the ratio of heat received in summer and winter is also constant, but the lengths of winter and summer vary, therefore the average amount of daily heat received in winter and summer during different years varies. This gives us a clue for one of the causes for an ice age.

The condition favourable for glaciation is, naturally, one where the winter is longer than the summer, and whenever that condition obtains in one hemisphere of course the reverse obtains in the opposite one. We can safely say, therefore, that 10,500 years ago the northern hemisphere, if not glaciated, was at all events, disposed towards glaciation, and very likely, in part, was glaciated. From astronomic reasoning, there would be a succession of periods tending towards glaciation, the effect of which other causes may mitigate, or even obliterate, or on the other hand, intensify.

The distribution of land and water, atmospheric and oceanic currents, of course, exert a powerful influence on the conditions brought about through astronomic causes. The preponderance of land in the northern hemisphere may possibly be due to the fact that during the critical time of crust-forming that hemisphere had its winters for thousands of years in aphelion.