of them in the older systems, that they must have required vastly greater time. Taking these criteria into account, it has been estimated that the time-ratios for the first three great ages may be as one for the Kainozoic to three for the Mesozoic and twelve for the Palæozoic, with as much for the Eozoic as for the Palæozoic. This is Dana's estimate. Another, by Hull and Houghton, gives the following ratios: Azoic, 34·3 per cent.; Palæozoic, 42·5 per cent.; Mesozoic and Kainozoic, 23·2 per cent. It is further held that the modern period is much shorter than the other periods of the Kainozoic, so that our geological table may have to be measured by millions of years instead of thousands.

We cannot, however, attach any certain and definite value in years to geological time, but must content ourselves with the general statement that it has been vastly long in comparison to that covered by human history.

Bearing in mind this great duration of geological time, and the fact that it probably extends from a period when the earth was intensely heated, its crust thin, and its continents as yet unformed, it will be evident that the conditions of life in the earlier geologic periods may have been very different from those which obtained later. When we further take into account the vicissitudes of land and water which have occurred, we shall see that such changes must have produced very great differences of climate. The warm equatorial waters have in all periods, as superficial oceanic currents, been main agents in the diffusion of heat over the surface of the earth, and their distribution to north and south must have been determined mainly by the extent and direction of land, though it may also have been modified by the changes in the astronomical relations and period of the earth, and the form of its orbit.* We know by the evidence of

* Croll. "Climate and Time."