

respectively those of Croll and Lyell, or the astronomical and geographical theories.

The late Mr. Croll has, in his valuable work "Climate and Time," and in various memoirs, brought forward an ingenious astronomical theory to account for changes of climate. This theory, as stated by himself, is that when the eccentricity of the earth's orbit is at a high value, and the northern winter solstice is in perihelion, agencies are brought into operation which make the south-east trade winds stronger than the north-east, and compel them to blow over upon the northern hemisphere as far as the Tropic of Cancer. The result is that all the great equatorial currents of the ocean are impelled into the northern hemisphere, which thus, in consequence of the immense accumulation of warm water, has its temperature raised, so that ice and snow must, to a great extent, disappear from the Arctic regions. In the prevalence of the converse conditions the Arctic zone becomes clad in ice, and the southern has its temperature raised.

At the same time, according to Croll's calculations, the accumulation of ice on either pole would tend, by shifting the earth's centre of gravity, to raise the level of the ocean and submerge the land on the colder hemisphere. Thus a submergence of land would coincide with a cold condition, and emergence with increasing warmth. Facts already referred to, however, show that this has not always been the case, but that in many cases submergence was accompanied with the influx of warm equatorial waters and a raised temperature, this apparently depending on the question of local distribution of land and water; and this, in its turn, being regulated not always by mere shifting of the centre of gravity, but by foldings occasioned by contraction, by equatorial subsidences resulting from the retardation of the earth's rotation, and by the excess of material abstracted by ice and frost from the Arctic regions, and drifted southward along the lines of arctic currents. This drift-