

require to be explained by physical changes affecting the earth as a whole, or at least the northern hemisphere. Many theoretical views have been suggested on this subject, and perhaps the most practical way of disposing of these will be first to set aside a number which are either precluded by the known facts, incapable of producing the effects, or altogether uncertain as to their possible occurrence.

1. In this class we may place the theory that the poles of the earth have changed their position. Independently of astronomical objections, there is good geological evidence that the poles of the earth must have been nearly in their present places from the dawn of life until now. From the Laurentian upward, those organic limestones which mark the areas where warm and shallow equatorial water was spreading over submerged continents are so disposed as to prove the permanence of the poles. In like manner all the great foldings of the crust of the earth have followed lines which are parts of great circles tangent to the existing polar circles. So, also, from the Cambrian age the great drift of sediment from the north has followed the line of the existing Arctic currents from the northeast to the southwest, throwing itself, for example, along the line of the Appalachian uplifts in eastern America, and against the ridge of the Cordilleras in the west.

2. Some of the above considerations, along with astronomical evidence, prevent us from assuming any considerable change in the obliquity of the axis of the earth during geological time.

3. That the earth and the sun have diminished in heat during geological time seems probable; but physical and geological facts alike render it certain that this influence could have produced no appreciable effect, even in the times of the earliest floras, and certainly not in the case of Tertiary vegetation.