

arises whether these events are not in some way a consequence of the condition of the crust then for the first time reached. The conclusion has been before stated; it is here announced in its place in geological history.

CLIMATE.

The climate of the United States, even the northern, during the early Tertiary, was at least warm-temperate, as indicated by the fossil plants.

There is evidence, as Asa Gray has remarked (1859, 1872), from the distribution of Tertiary plants in the Arctic, made known by Heer and others, and their relation to similar kinds in the eastern United States and in Asia, that the northern parts of the continents of America, Asia, and Europe were, during that age, under a nearly common forest vegetation, with a comparatively moderate climate. The genus *Sequoia*, of California, has its species (as Heer has shown) in the Eocene of Greenland, Arctic America, Iceland, Spitzbergen, northern Europe; and one Greenland species is very near the great Californian *S. gigantea*; and these were successors to Arctic Cretaceous species. There were two species of *Libocedrus* in the Spitzbergen Miocene (Heer); and one (*L. decurrens* Heer) now lives with the Redwoods of California, while the other occurs in the Andes of Chile. Gray adds that the common *Taxodium*, or Cypress, of the Southern States, occurs fossil in the Miocene of Spitzbergen, Greenland, and Alaska as well as Europe, and also, according to Lesquereux, in the Rocky Mountain Miocene. The Arctic Miocene is now made by Dawson and others probably Eocene in age.

Europe evidently passed through a series of changes in its climate, from tropical to temperate. According to Von Ettingshausen, the Eocene flora of the Tyrol indicates a mean temperature between 74° and 81° F.; and the species are largely Australian in character. The numerous Palms in England, at the same period, indicate a climate but little cooler.

The Miocene flora of the vicinity of Vienna the same author pronounces to be *subtropical*, or to correspond to a temperature between 68° and 79° F.; it most resembles that of subtropical America. Farther north in Europe, the flora indicates the *warm-temperate* climate characterizing the North American Tertiary; and it is also prominently North American in its types. In the Pliocene, the climate was cooler still, and approximated to that of the existing world.

The North American feature of the Miocene forests of Europe was probably owing to migration from *America* through the Arctic regions, and not from Europe; for a number of the European species, as shown by Lesquereux existed already in the American Laramie and Eocene. The Australian feature also may have been a result of migration, but from the opposite direction. The Indian Ocean currents favor migration northward, along the borders of Asia, and not that in the opposite direction.

What was the temperature of North America and the other continents at the close of the Tertiary, as a consequence of the addition of thousands of feet, and in some regions, of tens of thousands, to the height of the land, is to be learned from the events of the following era, the Quaternary.