

heat, flowing northward and eastward near its eastern border, but not much for the warming of North American waters north of Cape Hatteras; its heat is carried on for distribution over northern and western Europe and the Arctic seas. Heading off the Gulf Stream from the American coast north of Hatteras, there flows from the north a current of Arctic waters, that makes its escape from the polar basin by the only large passage way out—the way leading into the Atlantic; and these cold waters are like a cold wall along the eastern side of the continent. The American coast has a means of protection against the polar current, through an elevation of the border sufficient to make Newfoundland a peninsula by closing the Strait of Belle Isle. Moreover, if the elevation were only 500 feet, the eastern cape, around which the cold current would be forced to flow, would be set 250 miles east of its present position.

On the Pacific side a cold northwestern current follows the coast of North America from Alaska southward, as part of the normal oceanic circulation.

Thus at the present time North America has relatively cold waters along both its eastern and western shores. Hence there is reason enough for the paucity of its existing marine faunas. In Paleozoic time this contrast with Europe did not exist, or only to a small degree; for the Paleozoic species even exceed in numbers those of Europe. The Arctic basin was probably open widely in all directions. But in the early Mesozoic it must have become the closed basin which it now is, with its only free outlet into the Atlantic; and in this way the continent of North America was thus early put between northern cold Atlantic and cold Pacific currents.

The actual difference of temperature between the waters of the North American and European sides of the Atlantic in the Triassic and Jurassic periods is uncertain, because no marine fossils of these periods have been found on the American side. On the European side the presence of warm seas is proved by the profusion of marine species and by their kinds. The coral reefs of the Oölyte in England consist of corals of the same group with the reef-making species of the existing tropics. This favors the conclusion that the British waters, and nearly all the European, were within the coral-reef temperature limit; that is, the line along which 68° F. is the mean temperature of the year. The Oölytic isocryme of 68° F. (see map, page 47), accordingly, would have had nearly the position of the line of 44° F. in existing seas, but with a little less northing and more leaning to the eastward. The Gulf Stream was the probable cause of this long northward extension of warm waters in Jurassic time.

Further, in Europe, according to Neumayr, differences in the climate of the later Jurassic are indicated by the distribution of fossil Invertebrates. The Mediterranean Province, or that of southern Europe, including the regions of the Alps and Carpathians, Italy, Spain, and the Balkan peninsula, is characterized by Ammonites of the genera *Phylloceras*, *Lytoceras*, and *Simoceras*, with the Brachiopod *Terebratula diphya*. The Middle European Province, comprising the region of the Juras, France, Germany, England,