

TOPOGRAPHIC CHANGES IN THE INDIAN OCEAN; GONDWÁNA LAND.

The close relations in species of India and South Africa during the Permian and Triassic periods has led to the belief that the two were then connected by a belt of land, and Suess has named the emerged area "Gondwána Land," from the name of the series, including the Permian and Triassic beds, in India. R. D. Oldham remarks (1894) that "the plants of the India and Africa Coal-measures are absolutely identical; and among the few animals which have been found in the India deposits, one is indistinguishable from South African species, and another is closely allied; and both faunas are characterized by the remarkable group of Reptiles comprising the *Dicynodon* and other allied forms." In a map by Neumayr (1885), and its reproduction with some modifications by Oldham, the connecting belt of land extends from India south-southwestward over the Indian Ocean along the range of islands to Madagascar and southern Africa. Among the groups of islands there is the line of the Maldives and the Chagos group; then, farther west, the Seychelles group heading a line reaching to Newfoundland, and also, to the eastward, a line extending to the Mascarene Islands east of Madagascar. The emerged land makes an off-shore belt for eastern Africa, somewhat like the island range off the shores of eastern Asia, but more continuous. But great depths now exist between the groups.

The identity in *Permian* coal-plant vegetation is as great with Australia as with South Africa. The emerged land, on this evidence, has been supposed by some writers to have covered much of the Indian Ocean. But it is most probable that whatever connection existed for the migration of the plants, it was produced by the spreading of the Antarctic continent northward to a line between the parallels of 35° and 45° S. The absence of the Karoo Reptiles from Australia appears to indicate that the connection with South Africa was not complete; but it may be that the climate of the northern part of Antarctica was not warm enough to favor their migration, while sufficient for that of the plants. Australia also was enlarged; for Triassic fossil plants from New Zealand and New Caledonia show that these islands, as well as New Guinea, were then included within its limits.

The idea that Antarctic land of so great extent became emerged in the Permian era, or about that time, suggests a reason for the existence of evidences of glacial phenomena in the Permian of South Africa, India, and Australia. For such a geographical change would certainly have caused a general refrigeration of southern climates; and if sufficient to produce icy winters and glaciers about high summits, all the observed facts would have their explanation.