period. With the variations in the fineness, or other characteristics of the beds, as H. S. Williams has illustrated, the species vary. The fine shales of the Marcellus and Genesee shales have few and small species, owing to some unfavorable conditions; and, in part, the species are repeated in each later return of the beds to fine shales. With the coarser sand-beds of the Hamilton and Chemung, life abounds; but Brachiopods and Lamellibranchs predominate, especially in the latter, where Trilobites fail completely. With beds of intermediate character, as those of the Portage, life is much less abundant than in the Chemung — except at one time of change to beds allied to those of the Hamilton and Chemung (the Ithaca beds), when the life takes a character resembling that of the latter period. A thin limestone stratum in some cases indicates by the species an approximation again to the clearer waters of the Corniferous. There are thus alternations in living species correlatively with alternations in kinds of deposits. The species evidently migrated in the direction in which the conditions were favorable to them. The faunas of each stratum are not strictly faunas of epochs or periods of time, but local topographical faunas. After the Corniferous period, Corals, Crinoids, and Trilobites still flourished somewhere, as before; but they are absent from the Central Interior until the Carboniferous age opens.

The condition producing the Genesee shale in New York appears to have spread westward over Ohio, and to have invaded the Central Interior through Michigan, Indiana, the southern half of Illinois, and southward to Tennessee; and to have continued to prevail over this great region through the remainder of the Devonian era with but little change. The area was mud-making, with more evidence of fresh-water or brackish-water life than of marine conditions, and it probably had its extensive shallow lagoons and bayous in which lived the great Ganoids and Eurypterids. During the Later Devonian, in the Eastern Interior Sea, the Catskill sandstone to the northeast — a shore and off-shore formation of the Interior Continental Sea — reached a thickness of 3000 to 7545 feet (I. C. White), because it lay within the range of the Appalachian geosyncline.

If the condition of the Atlantic border, its sounds and bays, with their varying depths and fortunes, and of off-shore deeper waters and depositions and fresh-water inlets, be taken as a type of the conditions and depositions that existed in several successions within the Eastern Interior Sea, no difficulty will be found in finding a reason for all the variations in wave action, in tidal and current action, in depth, in purity of waters — ranging off to over-fresh or over-salt conditions, which may be needed to explain the geological and biological facts of the Middle and Later Devonian.

The effects of tidal currents appear to be marked in the Chemung beds of western New York and Pennsylvania, and eastern Ohio. The strata of coarse conglomerates occurring among the sand-beds appear to be due to their action. The tidal waters, which, in their rounds, converged from the south and west toward the head of the Eastern Interior Bay, with increasing height

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