the varying locations and effects of the marine currents, owing to varying depths and changing outlines of the land. The rocks of the northern border of the Interior area include much less limestone than those of the more central portion.

3. *Maximum thickness of the rocks in North America.* — The maximum thickness of the rocks of North America is not known. The methods of measurement of upturned rocks give so very doubtful results and lead generally to so large overstatements, that a trustworthy estimate cannot be made. It is, however, probable that the maximum thickness of the Cambrian is at least 20,000 feet, though only so where the rocks are mostly fragmental; of the Lower Silurian, 18,000 feet; of the Upper Silurian, 7000; of the Devonian, 14,000; of the Carbonic, 16,000; making a total of 75,000 feet.

The relative maximum thicknesses of the rocks have been used, first by S. Haughton, as a means of deducing the relative duration of geological eras and periods. There is great doubt over conclusions based on this criterion, because thickness is dependent so generally on a progressing subsidence — *no* subsidence giving little thickness, however many the millions of years that may pass. But as it is the only available method, it is still used.

Limestones increase with extreme slowness, five to ten feet of fragmental deposits accumulating in the time required for one foot of limestone. This general fact at least is plain, that Eopaleozoic time, or that of the Cambrian and Lower Silurian eras, was much longer than all the rest, for, as shown on pages 509, 520, it continued on after the first appearance of Fishes and Insects, types that were formerly supposed to date from the Devonian. The ratio for the Eopaleozoic, Upper Silurian, Devonian, and Carbonic is perhaps 7:1:2:2 or 8:1:2:2.

BIOLOGICAL CHANGES AND PROGRESS.

To appreciate the general system of biological progress, it is necessary to have some knowledge of the general principles under which successions of forms and structures were produced. The following is a brief review of some of the principles.

1. *From the simple, regular, or primitive in structure to the specialized.* — Some of the changes included, in cases generally of rising grade, are the following: (1) From a structure in which there are two or more functions to an organ, to one in which each function has its special organ (an organ being any part of a structure that is more or less independent in action, as even a digit or a tooth). (2) From a structure in which the organ corresponding to a special function has several uses, to one in which special forms exist in the same structure for each kind of use. (3) From simpler forms of specialization to more complex forms, better adapted to the required use. (4) From any specialized form to others adapted to newly acquired uses, with either accompanying rise or decline in general grade of structure. (5) From structures in which the head has large sense-organs and mouth-organs, to those having all the organs small, and the parts well compacted.