

facies of the Coblenzian fauna of the Rhine, and paralleled them with the Bohemian faunas of F, G, H, taken in their entirety; in 1880 he regarded them as a lower (not lowest) Devonian fauna and still as a calcareous facies of the Coblenzian; but in 1884 he appears to have resumed his original position as to the age of the Hercynian, and modified his conception of the parallelism with the Bohemian fauna by removing from his equivalent the lower portion of F. . . . BARROIS, in 1889, made the Hercynian lowest Devonian, but differed from Kayser (1878, 1880), in regarding it, not as a calcareous facies of the Spirifer-sandstein or Coblenzian, but as such a facies of the older Gedinnian, considering the Bohemian G as its equivalent."

Kayser concluded further that the Lower Helderberg formation of America was Hercynian, that is, lowest Devonian, contrary to the views of Barrande, who had made it Upper Silurian, and the equivalent of the three divisions in his Bohemian system just mentioned. In his recent *Lehrbuch* (1891), Kayser leaves the Water-lime in the Upper Silurian.

Some of the alleged Devonian characteristics of the Lower Helderberg are: its many species of *Dalmanites* of the *D. Hausmanni* type; its species of *Phacops*, of the type of *P. fecunda*, and of *Homalonotus*, of the type of *H. Vanuxemi*; the occurrence of many species of *Platyceras*; the special Devonian features among several genera of Brachiopods and Lamellibranchs. On the contrary the formation is unlike the Hercynian in containing no Goniatites, and like the Silurian in including several species of Cystideans. Mr. Clarke presents in his paper a full account of the discussion; and while he unhesitatingly refers the Oriskany formation to the Devonian, on the ground of its fauna, he leaves the question as to the Lower Helderberg without a decision. No attempt is made to compare the American fauna with that of the Ludlow beds of England, which is really the typical fauna of the later part of the Upper Silurian—the limits of the Devonian and Silurian having been first laid down by Murchison and Sedgwick.

GENERAL OBSERVATIONS ON THE UPPER SILURIAN.

GEOLOGICAL AND GEOGRAPHICAL CHANGES DURING THE UPPER SILURIAN.

NORTH AMERICAN.

In the region of the Appalachian geosyncline.—As in the Lower Silurian, the successive formations have their greatest thickness along the Appalachian geosyncline, and at the same time limestones were the prevailing rocks of the continental interior.

The thickness of the argillaceous beds and sandstones of the East indicate that during the Niagara period the deepening of the geosyncline amounted, in Pennsylvania, to at least 1500 feet in the Medina epoch, over 2000 in the Clinton, 1500 in the Niagara and Onondaga, and 500 in the Lower Helderberg,—in all 5500 feet. In the Onondaga period, the subsiding area extended up into New York, west of its center; for it was there that the Onondaga beds were formed to a thickness of 1000 feet, with evidence in many parts of shallow-water origin. In the Lower Helderberg, and in the following Oriskany periods, the greatest thickness of the beds was in the eastern half of the state.

No sediments for rock-making over the continent from the Atlantic Ocean.—Although the Champlain channel between the St. Lawrence seas and those of New York was again opened wide during the Lower Helderberg period, it