

iston. Thence they continue westward through Ontario with a thickness of 300 to 400 feet, and in eastern Ohio thin out to 10 to 150 feet of reddish shale (as found in deep borings) resting on Hudson or Utica shales. They are not found in Michigan. To the southward, in New York, the formation disappears beneath the later beds; but it reappears on the west slope of the Kittatinny Mountains, and outcrops to the southwest in east central Pennsylvania, Virginia, and eastern Tennessee.

The thickness of the Shawangunk grit is 500 feet in New York, and 700 to 800 feet in Pennsylvania; and that of the Medina beds, in the latter state, 1800 feet.

The beds thus give an idea of the seashore work of the period. They also indicate the generally shallow depths of the Eastern Interior Sea, but nothing as to the condition of the seas over the rest of the continent.

The *Clinton group* has a wide distribution. Its beds occur in central and western New York (the group taking its name from Clinton in Oneida County), in Pennsylvania, Ohio, Indiana, Wisconsin, eastern Tennessee, Kentucky, Alabama, and Georgia. The Cincinnati geanticline, which put above the surface the Lower Silurian rocks, accounts for the absence of the Clinton not only from part of Ohio, but also from western Kentucky and Tennessee. In New York and Pennsylvania the rock is mainly a shaly sandstone and shale of rough, irregular aspect, with some intercalated limestone; on the Niagara River it is about half limestone; and in Ohio and farther west almost wholly limestone.

A peculiar feature of the formation is the occurrence in many regions of one to three beds, 1 to 10 feet thick, of argillaceous red iron ore (hematite), usually oölytic, with the grains round or flattened. The grains are often concentric in structure, proving them to be true concretions, like those of an ordinary oölyte, and of sea-margin origin. (C. H. Smyth, from observations near Clinton, N.Y., and elsewhere in 1892.)

These ore-beds accompany the Clinton formation from New York to Alabama, through Pennsylvania, Virginia, eastern Kentucky, and Tennessee, and also occur in Wisconsin. They are usually fossiliferous, and the ore is sometimes called the "red fossil ore." The fossils are broken, and include stems of Crinoids, Bryozoans in small fragments, and other species. The beds were evidently made over tide-washed, salt-water flats, where trituration was gentle. They indicate a wonderful degree of uniformity in continental level over a wide area.

Clinton fossils occur with those of the Niagara at some points along the Atlantic border of Maine, from the boundary of New Brunswick to Penobscot Bay. They are found also in Nova Scotia, and on Anticosti several hundred feet of limestone are referred to the Clinton.

The *Niagara formation* is still more widely spread than the Clinton, though far from continental in its distribution. In most regions it is a thick limestone, but in New York and other parts of the *Eastern Interior Sea*, the lower portion is shale, indicating a gradual transition in rock-making condi-