

portion of the column. In Virginia the Clinton consists of sandstones and shales, mostly sandy, having an estimated thickness of not far from 850'. Beds of fossil or calcareous ore are present from central Pennsylvania to Alabama. (J. J. S.)

In east Tennessee the rocks are 200' to 300' thick, and include one or two beds of the oölitic iron ore.

In western Kentucky the oölitic red ore beds occur in Montgomery, Bath, and Fleming counties and along Pine Mountain.

(c) *Eastern Border region.* — In Nova Scotia, at Arisaig, which is within the *Acadian trough*, the rocks are shales and limestone, and have a thickness of about 500'. At the East River of Pictou, there are also slates and calcareous bands, probably of the same age. They include a deposit of oölitic iron ore, like that of the Clinton rocks of central New York, which in some places has a thickness of 40'. In southern New Brunswick the beds are like the Arisaig.

The fossiliferous Upper Silurian rocks of the coast of Maine, on the borders of the same *Acadian trough*, are described in Hitchcock's *Report on Maine*, 1861, and in papers by W. O. Crosby, *Am. Jour. Sc.*, xxiii., 1862; N. S. Shaler, *ib.*, xxxii., 1886; Dodge and Beecher, *ib.*, xliii., 1892. See also Foerste, on the iron ore, *ib.*, xli., 1891; and Smyth, on the same, *ib.*, xliii., 1892.

3. NIAGARA GROUP. — (a) *Interior Continental basin.* — At Rochester, N. Y., there are about 80' of limestone, overlying 80' of shale; and the limestone makes nearly the whole height of the upper fall. At Lockport there is a fine exhibition of the rock, and it includes an "encrinital" layer, which is mottled with red, and over it a bed full of delicate Corals. The limestone in some places breaks vertically into small columns, and such specimens have been called Stylolites. The structure is due, as explained by Marsh, to a slipping, through vertical pressure, of a part capped by a fossil shell against an adjoining part not so capped. Such Stylolites occur in limestones of other periods from the Cambrian to the Carboniferous.

The "Coralline limestone" is only 4' thick at the base of the Helderberg Mountains; but at Nearpass's quarry, south of Port Jervis, it is 50' thick, and contains numerous Niagara fossils.

The Guelph limestone (a dolomite), well seen at Galt and Guelph, in Ontario, western Canada, and farther west (formerly supposed to be of the age of the Salina beds), is the upper part of the Niagara limestone. The thickness in Ontario is about 160'.

The Niagara limestone and shale extend through Ohio and Indiana to Wisconsin and Iowa. But it is wanting in southern Illinois. The "Clear Creek limestone" of Union, Jackson, and Alexander counties is probably Lower Helderberg (Worthen). The rock has a wide distribution in Iowa (where it is in part the Leclaire limestone). Much of it is cherty, and has the fossils silicified. An analysis, by J. D. Whitney, of a specimen from Makoqueta County, Iowa, obtained calcium carbonate 52.18, magnesium carbonate 42.64, with 0.35 of sodium carbonate, traces of potash, iron carbonate, and sulphuric acid, 0.63 of alumina and iron sesquioxide, and 4.00 insoluble in acid. The beds form the summits of some of the mounds, as Table Mound, near Dubuque.

In west Tennessee the Meniscus limestone, 150' to 200' thick, noted for its fossil sponges, of which one is meniscus-shaped, is probably the equivalent of the Niagara limestone.

The Niagara beds of the Black Hills, near Deadwood, were identified through their fossils, by C. E. Beecher. In the Deadwood section there are Cambrian beds below, resting on Archæan; above, there is the Carboniferous limestone, with probably Devonian strata between.

(b) *Appalachian region.* — The Niagara has not been recognized distinctly in Pennsylvania; though in the central and southern portion of the state there occurs, at varying distances above the uppermost bed of iron ore, a succession of very thin limestones, which, in many localities, contain Niagara forms. This has been placed by Lesley in the lower