

rous shales next above, and the slates, shaly grits, and conglomerates, below, this formation. It is exposed on the western slope and in the west flanking hills of the Blue Ridge, through much of its length, often, by inversion, dipping to the southeast, in seeming conformity beneath the older rocks of the Blue Ridge, but often, also, resting unconformably upon or against them." These statements are cited from the *Reprint of the Annual Reports of 1835-1841, and Other Papers on the Geology of the Virginias*, by the late W. B. Rogers, 1884.

In Tennessee, the Lower Cambrian comprises the "Chilhowee" sandstones of Safford, and beneath these, probably, the Ocoee conglomerates and sandstones. West of Cleveland, in east Tennessee, it includes the lower part of the Knox sandstone of Safford (the Rome sandstone of Hayes, in Georgia), and the thick formation of limestone and shales below; while the central and upper portions of the Rome sandstone are Middle Cambrian. The same succession occurs near Knoxville. The Upper Cambrian is probably represented by the lower 2000' of the Knox dolomite. The typical New York fauna of the Upper Cambrian has not been recognized along the Appalachians in Pennsylvania, nor to the southwest. Lower Cambrian fossils have been observed in the lower part of the Rome sandstone near Rome, Ga., and in the limestones and shales of the Coosa series, in Coosa valley, Alabama, north and south of Cedar Bluff.

In northwestern Michigan and Wisconsin, south of Lake Superior, the Lake Superior sandstone, on the borders of the lake, rests unconformably on the Keweenaw formation, and is referred to the Cambrian. A broad area of Upper and Middle Cambrian with fossils skirts the Archæan area on the east and south, and consists of crumbling sandstone and arenaceous shale, with, in some places, much green sand (glauconite), and thin beds of limestone; the maximum thickness is 1000'. The quartzite occurring in isolated hills in the drift-covered region of Wisconsin in Barron County, and at Baraboo in Sauk County (the Baraboo quartzite), is made Huronian by Chamberlin and Irving, but Lower Cambrian by N. H. Winchell. At St. Croix River, the horizontally bedded Upper Cambrian rests on upturned red beds, which are Middle or Lower Cambrian, and are continuous with the pipestone quartzite of southwestern Minnesota, where *Lingulæ* have been found; in this quartzite, the pipestone bed (Catlinite), used for making pipe bowls by the Indians, is a layer of red argillaceous sandstone about a foot thick; the rock passing south into Iowa is the "Sioux quartzite" of C. A. White, and extends 10 miles into Dakota to Sioux Falls.

With regard to the fact of unconformability with the Archæan at Carp River, Professor J. D. Whitney states, in a letter to the author of Nov. 7, 1893, that "nothing could be clearer"; that "along the shores of Carp River and throughout the adjacent region, the sandstone strata are recognized as overlying the well-characterized beds of a much older formation which I designated as the 'Azoic Series.' At Carp River the nearly horizontal unaltered sandstone strata abut against and overlie the vertical edges of a well-marked quartzite." The Lower Magnesian series of Missouri, excepting the First, or Upper, limestone of the series, and the underlying Saccharoidal sandstone, is Cambrian. It consists of alternating strata of dolomite and sandstone. This Lower Magnesian series of Missouri is the Ozark series of Broadhead.

The Keweenaw beds were described by Foster and Whitney in 1850, 1851, and referred to the age of the Potsdam or Cambrian. The more recent reports are by Irving (1880, 1883, 1885) and Chamberlin (1883); and, with special reference to copper mining, by M. E. Wadsworth in 1880. The series consists of an upper division, consisting of ordinary sandstone and shales, free from igneous material, made 15,000' thick by Irving, and a lower division, 25,000' to 30,000' thick, made up of detrital and igneous rocks, but chiefly the latter. Chamberlin gives the same aggregate thickness, 45,000'. The igneous rocks are doleryte (diabase) with porphyritic and amygdaloidal varieties, gabbros, and also acid rocks as felsyte, felsyte-porphry, and others. (For a full account of the rocks, see Irving, *Report U. S. G. S.*, v., 4to, 1883.) As estimates of the thickness of upturned rocks