

These subdivisions are not all fully developed in any one district, but the average thickness of the whole is at least as great as in districts further south.

Traced northward into Scotland, the Carboniferous Limestone series undergoes a still further petrographical and palæontological change. Its massive limestones dwindle down, and are replaced by thick courses of yellow and white sandstone, dark shale, and seams of coal and ironstone, among which only a few thin sheets of limestone are to be met with. Scottish geologists have divided the lower half of their Carboniferous system into two well-marked series—the Calciferous Sandstones and the Carboniferous Limestone. The Calciferous Sandstone series is composed of two groups of strata—the lower of which, or Red Sandstone group, consists of red, white, and yellow sandstones, with blue, gray, green, and red marls or clays, while the upper or Cement-stone group is made up of white and yellow sandstones, blue, gray, green, and black shales and marls, thin coals, seams of limestone and cement-stone, and abundant volcanic rocks. The red sandstones pass down into the Upper Old Red Sandstone, from which they differ in the less intensity of their color, in the frequent gray and purplish tints they assume, in the absence of the deep brick-red marls so marked in the Upper Old Red Sandstone, and in the occurrence of carbonaceous streaks and tree-trunks, roots, and twigs. In the west of Scotland there occur among the red sandstones (some of which contain Upper Old Red Sandstone fishes) bands of limestone full of true Carboniferous Limestone corals and brachiopods. Hence it is evident that the Carboniferous Limestone fauna had already appeared outside the British area before the final cessation of the peculiar conditions of sedimentation of the Old Red Sandstone period. It was not, however, until these conditions had disappeared that the sea began to invade the lakes and creep over the sinking land of this part of Britain, and to bring with it the abundant Carboniferous Limestone fauna. The Calciferous Sandstones of Scotland represent a phase of sedimentation contemporaneous with the deposition of the Lower Limestone Shale and the Scaur Limestone of the Carboniferous Limestone series of England.

One of the most singular features of the Lower Carboniferous rocks of Scotland is the prodigious abundance of the intercalated volcanic rocks. So varied, indeed, are the characters of these masses, and so manifold and interesting is the light they throw upon volcanic action, that the region may