Scotland forms the northern portion of Great Britain and is divided from England by the rivers Sark, Liddell, and Kershope (an affluent of the Liddell), the Cheviot Hills, the river Tweed, and the liberties of Berwick. The mainland lies between 58° 40' 30" (at Dunnet Head, Caithness) and 54° 38' N. lat. (Mull of Galloway) and 1° 45' 30" (Peterhead) and 6° 14' W. long. (Ardnamurchan Point, Argyllshire). Including the islands, the extreme N. lat. is 60° 51' 30" (Outsack, Shetland) and the extreme W. long. 8° 35' 30" (St Kilda). Its greatest length from north to south, from Durness in Sutherland to Burrow Head in Wigtownshire, is 272 miles, and the greatest breadth from east to west, from Peterhead in Aber­deenshire to Applecross in Ross-shire, is 155, while the narrowest part, from Grangemouth in Stirlingshire to Bowling in Dumbarton­shire, is only 301/4 miles wide. The total area in 1881, according to the Ordnance Survey, was 19,777,490 acres or 30,902 square miles, —the area of foreshore being 310,413 acres or 485 square miles, of water 403,846 acres or 631 square miles, and of land-surface 19,063,231 acres or 29,786 square miles. But of the water area the acreage included under lakes and rivers respectively has not been ascertained.

Geology.

In the article Geology (vol. x. ) descriptions will be found of most of the geological formations of Scotland. All that need therefore be inserted here is a succinct summary of these formations with references to the pages of that article where fuller details are given.

The oldest rocks of Scotland and of the British Islands, known as Archæan, consist chiefly of gneiss (Fundamental, Lewisian, Hebridian), which varies from a coarsely crystalline granitoid mass to fine schist. The coarse varieties are most abundant, intermingled with bands of hornblende-rock, hornblende-schist, pegmatite, eurite, mica-schist, sericite-schist, and other schistose accompaniments. In a few places limestone has been observed. No trace of any organism has ever been detected in any of these rocks. Over wide areas, particularly on the mainland, the bands of gneiss have a general north-west trend and undulate in frequent plications with variable inclination to north-east and south-west. The largest tract of Archæan rock is that which forms almost the whole of the Outer Hebrides, from Barra Head to the Butt of Lewis. Other areas more or less widely separated from each other run down the western parts of Sutherland and Ross, and are probably continued at least as far as the Island of Rum. How far Archæan rocks reappear to the east of this western belt has not yet been ascertained.

Above the Archæan gneiss lies a series of red and chocolate-coloured sandstones, conglomerates, and breccias (Cambrian or Torridon sandstone), which form a number of detached areas from Cape Wrath down the seaboard of Sutherland and Ross, across Skye, and as far as the Island of Rum (Geology, vol. x. p. 330). They rise into prominent pyramidal mountains, which, as the stratification is usually almost horizontal, present in their terraced sides a singular contrast to the neighbouring heights, composed of highly plicated crystalline schists. In the Torridon district these sandstones can be seen towering bed above bed to a height of about 4000 feet, and their thickness is still greater. They have not yet yielded any recognizable fossil ; their geological age is accordingly doubtful, though from their relation to the overlying fossiliferous rocks and from their own lithological characters they have with much prob­ability been classed with the Cambrian system of Wales. They are not met with anywhere else in Scotland than in the north-west Highlands.

Rocks belonging to the Silurian system occur in two distinct regions and in two very strongly contrasted conditions. They constitute nearly the whole of the southern uplands (Geology, vol. x. pp. 333, 337). In that belt of country they consist for the most part of greywacke, grit, shale, and other sedimentary rocks, but in the south-west of Ayrshire they include some thick lenti­cular bands of limestone. They have been thrown into many plica­tions, the long axes of which run in a general north-easterly direction. It is this structure which has determined the trend of the southern uplands. The plications of the Highlands and the chief disloca­tions of the country have followed the same general direction, and hence the parallelism and north-easterly trend of the main topo­graphical features. Abundant fossils in certain parts of the Silurian rocks have shown that representatives of both the Lower and Upper divisions are present. By far the larger part of the uplands belongs to the former. The Upper Silurian shales and sandstones appear only along the northern and southern margins.

In the north-west Highlands the Cambrian red sandstones are overlain unconformably by several hundred feet of white quartzite with annelid tubes, followed by fossiliferous limestones and shales (Geology, vol. x. p. 333). The abundant fossils in these strata prove them to be of Lower Silurian age. It was believed by Murchison that, as these Silurian strata dip conformably below various schists which spread eastwards into the rest of the High­lands, they demonstrate the crystalline rocks of the Highlands to

be of later than Silurian age. Recently, however, the structure of Sutherland has been investigated anew with minute care and the result is to show that the schists believed to overlie the Silurian strata conformably have been really pushed over them and consist in part of the Archæan gneiss. It has been ascertained that from the mouth of Loch Erriboll on the north coast of Sutherland south­wards to the Isle of Skye, a distance of more than 100 miles, a gigantic system of earth-movements has taken place, whereby the Silurian, Cambrian, and Archæan rocks have been crumpled, inverted, dis­located, and have pushed over each other. In some places the hori­zontal displacement of these shifted masses has been not less than 10 miles. So intense has been the shearing of the rocks that their original structure has in many places been entirely destroyed. They have acquired a new schistosity, which is in a general sense parallel with the bedding of the Silurian rocks to the west of the line of disturbance. Hence the apparent conformability of the schists overlying these rocks. The total thickness of recognizable Silurian strata is about 2000 feet. The rocks that overlie them to the east of the line of disturbance in Sutherland and Ross are fine flaggy schists, quite unlike any part of the Archæan gneiss and often strangely suggestive of altered sandstones. What are their true age and history remains still to be determined. There can be no doubt, however, that they have acquired their present schistosity since the Lower Silurian period, and hence that the present condi­tion of the metamorphic rocks of the central Highlands does not go back to Archæan time. That portions of the Archæan series may have been pushed up in different parts of the Highlands is quite conceivable. But that much of the Highlands consists of altered sedimentary rocks like those of the Silurian uplands admits of no question. The solution of this difficult but interesting problem has the most important bearing upon the theory of meta­morphism, but it can only be attained by patient and laborious mapping of the ground such as is being prosecuted by the Geo­logical Survey.

As Scotland is the typical European region for the Old Red Sandstone a full account of this series of rocks has already been given in the article Geology (vol. x. pp. 343, 344). These rocks are grouped in two divisions, Lower and Upper, both of which appear to have been deposited in lakes. The Lower, with its abun­dant intercalated lavas and tuffs, extends continuously as a broad belt along the northern margin of the midland valley, reappears in detached tracts along the southern border, is found again on the south side of the uplands in Berwickshire and the Cheviot Hills, occupies a tract of Lome in Argyllshire, and on the north side of the Highlands underlies most of the low ground on both sides of the Moray Firth, stretches across Caithness and through nearly the whole of the Orkney Islands, and is prolonged into Shetland. The Upper Old Red Sandstone covers a more restricted space in most of the areas just mentioned, its chief development being on the flanks of the north-eastern part of the southern uplands, where it spreads out over the Lammermuir Hills and the valleys of Berwick­shire and Roxburghshire.

The areas occupied by Carboniferous rocks are almost entirely restricted to the midland valley, but they are also to be found skirting the southern uplands from the mouth of the Tweed to that of the Nith. The subdivisions of this important system, its coal-fields and igneous rocks, have been described in the article Geology (vol. x. pp. 346, 348, 349).

Rocks assignable to the Permian system occupy only a few small areas in Scotland. Extending from Cumberland under the Solway Firth, they fill up the valley of the Nith for a few miles north of Dumfries, and, reappearing again in the same valley a little farther north, run up the narrow valley of the Carron Water to the Lowther Hills. Other detached tracts of similar rocks cover a considerable space in Annandale, one of them ascending the deep defile at the head of that valley. Another isolated patch occurs among the Lead Hills ; and lastly, a considerable space in the heart of the Ayrshire coal-field is occupied by Permian rocks. Throughout these separate basins the prevailing rock is a red sandstone, varied in the narrow valleys with intercalated masses of breccia (Geology, vol. x. p. 351). There can be no doubt that the valleys in which these patches of red rocks lie already existed in Permian time. They seem then to have been occupied by small lakes or inlets, not unlike fjords. Numerous amphibian tracks have been found in the red sandstone of Annandale and also near Dumfries, but no other traces of the life of the time. One of the most interesting features of the Scottish development of the Permian system is the occurrence of intercalated bands of contemporaneously erupted volcanic rocks in the Carron Water, Nithsdale, and Ayrshire. The actual vents which were the sites of the small volcanoes still remain distinct, and the erupted lavas form high ground in the middle of Ayrshire.

The Triassic system appears to be only feebly represented in Scotland. To this division of the geological record are assigned the yellow sandstones of Elgin, which have yielded remains of rep-