Clyde to Stonehaven, on the south side by the pastoral uplands that stretch from Girvan to Dunbar. The simplest conception of the general aspect and structure of this important part of the king­dom is obtained by regarding it as a long trough of younger rocks let down by parallel dislocations between the older masses of the high grounds to the south and north. The lowest of these younger rocks are the various sedimentary and volcanic members of the Old Red Sandstone. These are covered by the successive formations of the Carboniferous system. The total thickness of both these groups of rock cannot be less than 30,000 feet, and, as most of them bear evidence of having been deposited in shallow water, it is manifest that they could only have been accumulated during a prolonged period of depression. The question arises whether this depression affected only the area of the midland valley itself, or whether it extended also over the regions to the north and south. Materials do not yet exist for a delinite answer to this question ; but so far as the evidence now before us goes there is ground for the infer­ence that, while the depression had its maximum along the line of the lowlands, it also involved some portion at least of the high grounds on either side. In other words, the Old Red Sandstone and Carboniferous rocks, though chiefly accumulated in the broad lowland valley, crept also over some part at least of the hills on either side, where a few outliers are left to tell of their former ex­tension. The central Lowlands of Scotland are thus of great geo­logical antiquity. During and since the deposition of the rocks that underlie them the tract has been the scene of repeated ter­restrial disturbances. Long dislocations, running like the ridges of the Highlands and the southern uplands from south-west to north-east, have sharply defined its northern and southern margins. By other fractures and unequal movements of upheaval or depres­sion portions of the older rocks have been brought up within the bounds of the younger, and areas of the younger have been enclosed by the older. On the whole, these terrestrial disturbances have followed the same prevalent north-easterly trend, and hence a general tendency may be observed among the main ridges and valleys to run in that direction. The chains of the Ochil, Sidlaw, Pentland, Renfrew, Campsie, and Fintry Hills, and the valleys of Strathmore, Firth of Tay, and the basin of Midlothian, may be cited as examples. But, undoubtedly, the dominant cause in the determination of the topographical prominences and depressions of the district has been the relative hardness and softness of the rocks. Almost the whole of the eminences in tho Lowlands consist of hard igneous rocks, forming not only chains of hills like those just referred to and others in Ayrshire and Lanarkshire, but isolated crags and hills like those of Stirling Castle, Edinburgh Castle, and others conspicuous in the scenery of Fife and the Lothians.

Of the three chief valleys in the central Lowlands two, those of the Tay and the Forth, descend from tho Highlands, and one, that of the Clyde, from the southern uplands. Though on the whole transverse, these depressions furnish another notable example of that independence of geological structure already mentioned.

We now proceed to consider the leading physical features of the country with especial reference to their distinctive aspects and their respective modes of origin. Though an eminently hilly country, Scotland is not dominated by any leading mountain chain on which all the other topographical features are dependent. Its leading features are not the monotonous ridges of the high grounds but the valleys that have been opened through them. If these valleys were tilled up, the high grounds would once more become what they probably were at first, elevated plains or plateaus, with no strongly marked features,—no eminences rising much above nor hollows sinking much below the general surface.

*Valleys.—*Even apart from any knowledge of their origin, the valleys of the country are thus seen to be its fundamental topo­graphical element, and to deserve the first consideration in any attempt to describe and explain its physical features. The longi­tudinal valleys, which run in the same general direction as the ridges—that is, north-east and south-west—have had their trend defined by geological structure, such as a line of dislocation (the Great Glen), or the plications of the rocks (Lochs Ericht, Tay, and Awe, and most of the sea lochs of Argyllshire). The transverse valleys run north-west or south-east and are for the most part in­dependent of geological structure. The valley of the Garry and Tay crosses the strike of all the Highland rocks, traverses the great fault on the Highland border, and finally breaks through the chain of the Ochil Hills at Perth. The valley of the Clyde crosses the strike of the Silurian plications in the southern uplands, the boundary fault, and the ridges of tho Old Red Sandstone, and pursues its north-westerly course across the abundant and often powerful dislocations of the Carboniferous system.

That valleys are essentially due to erosion and not to dislocation . or subsidence of the earth’s surface is a fact which has now been demonstrated by so overwhelming a mass of evidence from all parts of the globe that it may be accepted as one of the axioms of geology. The plications of the earth’s crust which folded the rocks of the Highlands and southern uplands not improbably upraised above the sea a series of longitudinal ridges having a general north-easterly

direction. The earliest rain that fell upon these ridges would run off them, first in transverse watercourses down each short slope and then in longitudinal depressions wherever such had been formed during the terrestrial disturbance. Once chosen, the pathways of the streams would be gradually deepened and widened into valleys. Hence the valleys are of higher antiquity than the mountains that rise from them. The mountains in fact have emerged out of the original bulk of the land in proportion as the valleys have been excavated. The denudation would continue so long as the ground stood above the level of the sea ; but there have been prolonged periods of depression, when the ground, instead of being eroded, lay below the sea-level and was buried sometimes under thousands of feet of accumulated sediment, which completely filled up and obliterated the previous drainage-lines. When the land reappeared a new and independent series of valleys would at once begin to be eroded ; and the subsequent degradation of these overlying sedi­ments might reveal portions of the older topography, as in the case of the Great Glen, Lauderdale, and other ancient valleys. But the new drainage-lines have usually little or no reference to the old ones. Determined by the inequalities of surface of the overlying mantle of sedimentary material, they would be wholly independent of the geological structure of the rocks lying below that mantle. Slowly sinking deeper and deeper into the land, they might event­ually reach the older rocks, but they would keep in these the lines of valley that they had followed in the overlying deposits. In process of time the whole of these deposits might be denuded from the area. The valleys would then be seen running in utter dis­regard of the geological structure of the rocks around them, and there might even remain no trace of the younger formations on which they began and which guided their excavation. This is probably the explanation of the striking independence of geological structure exhibited by the Tweed and the Nith.

Among the valleys of Scotland certain prevailing characteristics have been recognized in the popular names bestowed upon them.

“ Straths ” are broad expanses of low ground between bounding hills usually traversed by one main stream and its tributaries,— Strath Tay, Strath Spey, Strath Conon. The name, however, has also been applied to wide tracts of lowland which embrace portions of several valleys, but are defined by lines of heights on either side ; the best example is afforded by Strathmore—the “great strath”— between the southern margin of the Highlands and the line of the Ochil and Sidlaw Hills. This long and wide depression, though it looks like one great valley, strictly speaking, includes portions of the valleys of the Tay, Isla, North Esk, and South Esk, all of which cross it. Elsewhere in central Scotland such a wide depres­sion is known as a “liowe,” as in the Howe of Fife between the Ochil and Lomond Hills. A “ glen ” is usually a narrower and steeper - sided valley than a strath, though the names have not always been applied with discrimination. Most of the Highland valleys are true glens. The hills rise rapidly on either side, some­times in grassy slopes, sometimes in rocky bosses and precipitous cliffs, while the bottom is occupied by a fiat platform of alluvium through which a stream meanders. Frequently the bottom of some part of the valley is occupied by a lake. In the south of Scotland the larger streams flow in wide open valleys called “dales,” as in Clydesdale, Tweeddale, Teviotdale, Liddisdale, Eskdale, Nithsdale. The strips of alluvial land bordering a river are known as “liaughs,” and where in estuaries they expand into wide plains they are termed “carses.” The carses of the Forth extend seawards as far as Bor- rowstounness and consist chiefly of raised beaches. The Carse of Gowrie is the strip of low ground intervening between the Firth of Tay and the line of hills that stretches from Perth to Dundee.

River-gorges are characteristic features in many of the valleys of Scotland. In the Old Red Sandstone they are particularly promi- nent where that formation has lain in the pathway of the streams sweeping down from the Highlands. In the basin of the Moray Firth some fine examples may be seen on the Nairn and Findhorn, while on the west side of tho Cromarty Firth some of the small streams descending from the high grounds of the east of Ross-shire have cut out defiles in the conglomerate, remarkable for their depth and narrowness. On the south side of the Highlands still more notable instances of true “canons” in the Old Red Sandstone are to be seen where the Ericht, Isla, and North Esk enter that forma­tion. The well-known gorge in which the Falls of Clyde arc situated is the best example in the midland valley. @@1

*Types of Mountain ami Hill. —* While the topography of the country is essentially the result of prolonged denudation, we may reasonably infer that the oldest surfaces likely to be in any measure preserved or indicated are portions of some of the platforms of erosion which have successively been produced by the wearing away of the land down to the sea-level. Relics of these platforms seem to be recognizable both in the Highlands and among the southern uplands. Allusion has already been made to the remarkable flat- topped moorlands which in the eastern Grampians reach heights

@@@1 For the principal rivers, the Tay, Spey, Forth, Clyde, and Tweed, see the separate articles, and for the Dee (Aberdeen, Kirkcudbright), &c., see articles on the respective counties.