terrestrial disturbances. Long dislocations 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 dis­turbances have followed the 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 the Strathmore, Firth of Tay, and the basin of Midlothian may be cited as examples. But 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 all the eminences in the Lowlands consist of hard igneous rocks, forming not only chains of hills such as those just mentioned and others in Ayr­shire and Lanarkshire, but isolated crags and hills like those on which stand the castles of Edinburgh and Stirling, 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 the 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 referred to.

*The Southern Uplands* extend from the North Channel in the south- west to St Abb’s Head in the north-east and form a well-defined belt of hilly ground, and though much less elevated (their highest point is 2764 ft. above the sea) than the Highlands, rise with scarcely less abruptness above the lower tracts that bound them. Their north- western margin for the most part springs boldly above the fields and moorlands of the Central Plain, and its boundary for long distances continues remarkably straight. On the south and south-east their limits in general are less prominently defined, but are better seen west and south-west of the Nith from which they extend to the sea and Loch Ryan, terminating in the extreme south-west in a plateau of which the loftiest point is little over 1000 ft. above the sea. The Cheviots do not properly belong to the Uplands, from which they are separated by Liddesdale and other hollows and on which they abut abruptly. But though geologically the one set of mountains must be separated from the other, geographically it is convenient to include within the Southern Uplands the whole area between the Central Plain and the Border. A survey of the Uplands, therefore, presents in succession from south-west to north-east the Kirkcudbrightshire and Ayrshire mountain moors, the Lowthers, the Moffat hills, the Moorfoots and the Lammermuirs. Distinguished especially by the smoothness of their surface, they may be regarded as a rolling table­land or moorland, traversed by many valleys conducting the drainage to the sea. This character is well observed from the heights of Tweedsmuir. Wide, mossy moors, 2000 ft. or more above the sea, and sometimes level as a racecourse, spread out on all sides. Their continuity, however, is interrupted by numerous valleys separating them into detached flat-topped hills, which are comparatively seldom marked by precipices of naked rock. Where the rock projects it more usually appears in low crags and knolls, from which long trails of grey or purple debris descend till they are lost among the grass. Hence, besides being smooth, the uplands are remarkably verdant. They form indeed excellent pasture-land, while the alluvial flats in the valleys and even some of the lower slopes are fitted for grain and green crops.

This uniformity of aspect is doubtless traceable to the prevalence of the same kind of rocks and the same geological structure. The Silurian greywackes and shales that underlie almost the whole of the Uplands weather generally into small angular debris, and at a tolerably uniform rate of disintegration. But slight differences may readily be detected even where no feature interferes noticeably with the monotony The bands of massive grit and coarse greywacke, for example, break up into larger blocks and from their greater hardness are apt to project above the general surface of the other softer rocks. Hence their line of trend, which like that of all the other strata is in a north-easterly direction, may be traced from hill to hill by their more craggy contours. Only in the higher tracts are there rugged features recalling the more savage character of Highland scenery. In the heights of Hartfell (2651 ft.) and Whitecoomb (2695), whence the Clyde, Tweed, Annan, and Moffat Water descend, the high moorlands have been scarped into gloomy corries, with crags and talus-slopes, which form a series of landscapes all the more striking from the abrupt and unexpected contrast which they effer to everything around them. In Galloway, also, the highest portions of the Uplands have acquired a ruggedness and wildness more like those of the Highlands than any other district in the south of Scotland. For this, however, there is an obvious geological reason. In that region the Silurian rocks have been invaded by large bosses of granite and have undergone a variable amount of metamorphism which has in some places altered them into hard crystalline schists. These various rocky masses, presenting great differences in their powers of resisting decay, have yielded unequally to disintegration: the harder portions project in rocky knolls, crags and cliffs, while the softer parts have been worn down into more flowing outlines. The highest summit in the south of Scotland—Merrick (2764 ft.)—consists of Silurian strata much altered by proximity to the granite, while the rest of the more prominent heights (all in Kirkcudbrightshire)—

Rinns of Kells (2668 ft.), Cairnsmuir of Carsphairn (2612), and Cairnsmore of Fleet (2331)—are formed of granite.

The watershed of the Southern Uplands is of much interest in relation to their geological history. It runs from the mouth of Loch Ryan in a sinuous north-easterly direction, keeping near the northern limit of the region till it reaches the basin of the Nith, where it quits the Uplands altogether, descends into the lowlands of Ayrshire, and, after circling round the headwaters of the Nith, strikes south-eastwards across half the breadth of the Uplands, then sweeps north and eastwards between the basins of the Clyde, Tweed and Annan, and then through the moors that surround the sources of the Ettrick, Teviot and Jed, into the Cheviot Hills. Here again the longest slope is on the east side, where the Tweed bears the whole drainage of that side into the sea. Although the rocks throughout the Southern Uplands have a persistent north- easterly and south-westerly strike, and though this trend is apparent in the bands of more rugged hills that mark the outcrop of hard grits and greywackes, nevertheless geological structure has been much less effective in determining the lines of ridge and valley than in the Highlands. On the southern side of the watershed, in Dumfries­shire and Galloway, the valleys run generally transversely from north-west to south-east. But in the eastern half of the Uplands the valleys do not app'ar to have any relation to the geological structure of the ground underneath.

*Characteristic Features.—*Though Scotland is pre-eminently a “ land of mountain and of flood,” yet its leading physical features are not the lofty ridges carved out of the primeval plateau —apparently the dominant characteristic—but the valleys which have been opened through them by the agencies of water and weather, and which are therefore its fundamental topographical element. 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 Sidlaw Hills at Perth. The valley of the Clyde crosses the strike of the Silurian folds in the Southern Uplands, the boundary fault, and the ridges of the Old Red Sandstone, and pursues its north­westerly course across the abundant and often powerful dislocations of the Carboniferous system.

The crumpling of the earth’s crust which folded the rocks of the Highlands and Southern Uplands probably upraised above the sea a series of longitudinal ridges having a general north-easterly direction. Thy 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. Afterwards the pathways of the streams would be gradually deepened and widened into valleys. Hence the valleys are of higher antiquity than the mountains that flank them. The mountains in fact have been hewn 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 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 elder 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, and there might even remain no trace of the younger formations on which the valleys 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 certain prevailing characteristics have been recognized in their popular names. *Straths* are broad expanses of low ground between bounding hills and arc usually traversed by one main stream and its tributaries—*e.g.* Strath Tay, Strath Spey, Strath Conon. This 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 each side; the best example is afforded by Strathmore-—the “ Great Strath ”—between the southern margin of the Highlands and the line of the 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 *howe,* as in the Howe of Fife between the Ochil and Lomond Hills. A *glen* is a narrower and steeper-sided