

cleavage is the first effect;" or, at any rate, that the crystalline force may have been most energetic in the direction of cleavage. As bearing on this view, he says, "I was particularly struck in the eastern parts of Terra del Fuego with the fact that the fine laminae of clay-slate, where they cut straight through the bands of stratification, and therefore indisputably true cleavage-planes, differ slightly from one another in their grayish and greenish tints of color, as also in their compactness, and in some laminae having a more jaspery appearance than others. This fact shows that the same cause which has produced the highly fissile structure has altered in a slight degree the mineralogical character of the rock in the same planes."* As one step farther towards tracing a passage from planes of cleavage to those of foliation, Professor Sedgwick observes that in North Wales the surfaces of slates are sometimes coated over with chlorite, "the crystals of which have not only defined the cleavage planes but struck through the whole mass of the rock."† So also, says Mr. Darwin, in some places in South America crystals of epidote and of mica coat the planes of cleavage.

Mr. D. Sharpe inferred from observations made by him in the Highlands of Scotland, in 1851, that the foliation of the gneiss and mica-schist are upon the whole parallel to one another, but have no connection with any original planes of stratification; and he also conceives that the planes both of cleavage and foliation in the Grampians and in the region of Mont Blanc in Switzerland (which last he examined in 1854) are parts of great curves or anticlinal axes of considerable regularity.‡ In like manner in South America the cleavage planes of the clay-slate had been suspected by Mr. Darwin, notwithstanding their varying and opposite dips, to be parts of large curves or foldings, having their summits cut off and worn down.§

There seems to be no difficulty in imagining that in rocks of *homogeneous* composition the foliation may take place along planes previously caused by the elongation of the materials along the dip of the cleavage; for experienced geologists have been at a loss to decide in many countries which of two sets of divisional planes were referable to cleavage, and which to stratification; and after much doubt, have discovered that they had at first mistaken the lines of cleavage for those of deposition, because the former were by far the most marked of the two. Now if such slaty masses should become highly crystalline, and be converted into gneiss, hornblende-schist, or any other member of the hypogene class, the cleavage planes would be more likely to remain visible than those of stratification. Professor Henslow had noticed, so long ago as the year 1821, that the lamination of the chloritic and other crystalline

* Geol. Observ. on South America, p. 155.

† Sedgwick, Geol. Trans. 2d ser. vol. iii. p. 471.

‡ D. Sharpe, Phil. Trans. 1852, and Geol. Quart. Journ. No. 41, 1855.

§ Darwin, S. America, p. 155.