

composed primarily of compact clay, sometimes with megascopic and microscopic scales of one or more micaceous minerals, granules of quartz and cubes or concretions of pyrites, as well as veins of quartz and calcite. The fissile structure is specially characteristic. In some cases this structure coincides with that of original deposit, as is proved by the alteration of fissile beds with bands of hardened sandstone, conglomerate or fossiliferous limestone. But for the most part as the rocks have been much compressed, the fissile structure of the argillaceous bands is independent of stratification, and can be seen traversing it. Sorby has shown that this superinduced fissility or "cleavage" has resulted from an internal rearrangement of the particles in planes perpendicular to the direction in which the rocks have been compressed (see Book III. Part I. Section iv. § 3). In England the term "slate" or "clay-slate" is given to argillaceous, not obviously crystalline rocks possessing this cleavage-structure. Where the micaceous lustre of the finely disseminated superinduced mica is prominent, the rocks are phyllites.

Microscopic examination shows that while some argillaceous rocks consist mainly of granular *débris*, many cleaved clay-slates contain a large proportion of a micaceous mineral in extremely minute flakes, which in the best Welsh slates have an average size of $\frac{1}{2000}$ of an inch in breadth, and $\frac{1}{8000}$ of an inch in thickness, together with very fine black hairs which may be magnetite.¹²⁰ Moreover, many clay-slates, though to outward appearance thoroughly noncrystalline, and evidently of fragmental composition and sedimentary origin, yet contain, sometimes in remarkable abundance, microscopic microlites and crystals of different minerals placed with their long axes parallel with the planes of fissility. These minute bodies include yellowish-brown needles of rutile, greenish or yellowish flakes of mica, scales of calcite, and probably other minerals.¹²¹ Small granules of quartz containing fluid-cavities, show on their surfaces a distinct blending with the substance of the surrounding

¹²⁰ Sorby, Q. J. Geol. Soc. xxvi. p. 68.

¹²¹ These "clay-slate needles" were probably not crystallized contemporaneously with the deposit of the original rock. In some cases they may have been deposited with the rest of the sediment as part of the *débris* of pre-existing crystalline rocks (see p. 228); but in general they appear to have been developed where they now occur by subsequent actions (see *postea*, pp. 531, 532). For their character see Zirkel, "Mik. Beschaff." p. 490. Kalkowsky, N. Jahrb. 1879, p. 382; A. Cathrein, op. cit. 1882 (i.) p. 169. F. Penck, Sitzb. Bayer. Akad. Math. Phys. 1880, p. 461. A. Wichmann, Q. J. Geol. Soc. xxxv. p. 156.