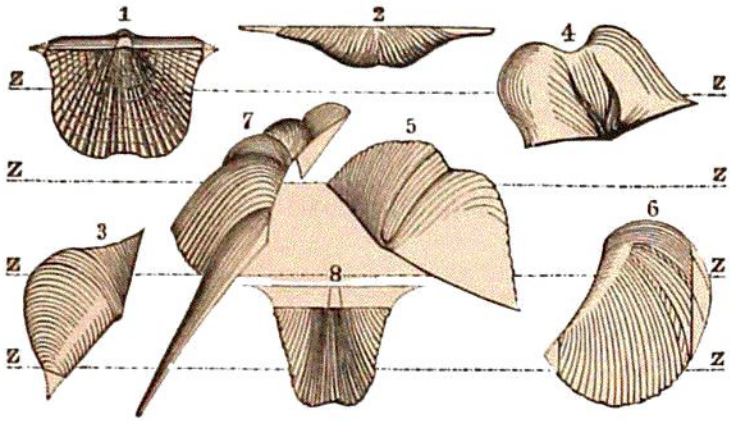
and become compressed in the direction of the pressure, and extended at right angles to it; and other earthy beds have suffered more or less in a like way. But strata of quartz sands, not firmly cemented, have accommodated themselves to the pressure in part by rearrangements of the grains; and those of limestone, and hard quartzyte, brittle rocks, mostly by fracturing, displacement, and recementation.

The distortions of fossils vary according to the relation in position between the planes of bedding or cleavage of the rock, and the axial plane at right angles, or nearly so, to the direction of pressure. The inequalities in the pressure and in the varying resistances to motion were a cause of a warping of the beds on a large scale, which had its effects. Hence stretchings, slippings, and contractions of fossils are common in such beds.

Some examples are shown in the following figures from a paper by D. Sharpe (1847, *Q. J. G. Soc.*), illustrating cases observed by him in a slate rock in Wales. They represent two species of shells, the *Spirifer disjunctus* (Nos. 1 to 4) and the *Spirifer giganteus* (Nos. 5 to 8). No. 1 is the natural form of *S. disjunctus;* the others are distorted. The lines *zz* show the lines of cleavage in the slate: 2 lay in the rock inclined 60° to the planes of cleavage, and is shortened one half; 3 lay obliquely at an angle of 10° or 15°, and shortened above the middle and lengthened below it; 4 is a cast, the upper part pressed beneath that shown, while the lower is much drawn out; 5 is like 3, the angle with the cleavage-plane being less than 5°, and the lower part has lost its plications by the pressure and extension; 6 has a similar angle to the cleavage-plane, but a different position; 7 intersects the cleavage-plane at only 1°, and its lower part is very much elongated. Compression, a sliding of the rock at the cleavage-planes, and more especially a spreading of the rock itself under the pressure, are the causes which have produced these distortions. All fossils are liable to become similarly misshapen under the same conditions.

344.



3. *Foliation, slaty structure.*—Roofing slates exemplify cleavage-structure, or foliation. They are most common on the outskirts of regions of disturbance. Slaty cleavage often graduates into the foliated structure of hydromica and mica schists. The fact that slaty structure is not coincident with the bedding-planes was explained by Sedgwick in 1835, from observations in Wales. Sorby first pointed out (1849) that the structure was due to the forcing of all flattened and linear particles into parallel planes, approximately perpendicular to the pressure; and that all air-cavities and particles of moisture are flattened likewise. He sustained his conclusions by microscopic examinations, and by subjecting to pressure clay and scales of oxide of iron. Tyndall rendered beeswax, clay, and other substances, laminated