the cooling shall take place slowly, principally from one or more of its surfaces." In the more perfectly columnar basalts, the columns are sometimes articulated, each prism being separable into vertebræ, with a cup-and-ball socket at each articulation (Figs. 231 and 232). This peculiarity was traced by Mr. Mallet to the contraction of each prism in its length and in its diameter, and to the consequent production of transverse joints, which, as the resultant of the two contracting strains, are oblique to the sides of the prism, but, as the obliquity lessens toward the centre, assume necessarily when perfect, a cup-shape, the convex surface pointing in the same direction as that in which the prism has grown.

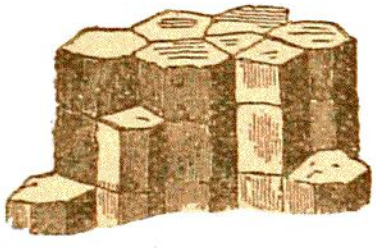

Fig. 230.—Ordinary columnar structure of lava.

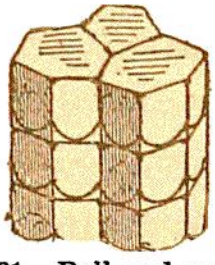

Fig. 231.—Ball-and-socket jointing of columns.

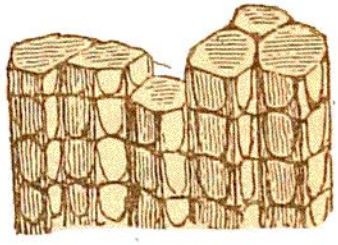

Fig. 232.—Modification of ball-and-socket structure.

This explanation, however, will hardly account for cases, which are not uncommon, where the convexity points the other way, or where it is sometimes in one direction and sometimes in the other.[10] The remarkable spheroids (Fig. 94) which appear in many weathered igneous rocks besides basalts may be due, where they are not the result of weathering, to continued contraction within the hexagonal or polygonal spaces defined by the columnar joints and cross-joints of a cooling mass. The contraction of these blocks would

[10] Mr. Scrope pointed this out (Geol. Mag. September, 1875), though Mr. Mallet (ibid., November, 1875) replied that in such cases the articulations must be formed just about the dividing surface, between the part of the rock which cooled from above and that which cooled from below. See also on this subject J. P. O'Reilly, Trans. Roy. Irish Acad. xxvi. 1879, p. 641.