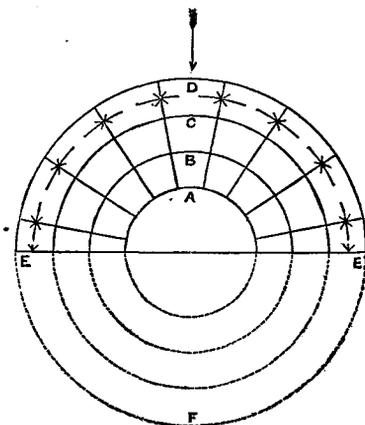


GRAVITATION, COMPRESSION, AND SLATY CLEAVAGE.

SIR,—Dr. Sterry Hunt, in his paper in the February Number of the *MAGAZINE*, referring to the alleged condensing power of the superincumbent mass on the central parts of the earth, remarks: “The condensing effect of pressure was by Dr. Young estimated to be sufficient to reduce a mass of granite at the earth’s centre to the eighth of its bulk at the surface, which would give the earth a mean density equal to twelve or thirteen times that of water: this consideration has led a recent writer in the London *Athenæum* to conclude with Herbert Spencer that our earth and the other planets may be only shells of varying thickness, enclosing a central cavity filled with vaporous matter, by which hypothesis we may explain their comparatively feeble densities.” Mr. David Forbes has also noticed that the average density of the earth falls short of what it would be, supposing it grew denser in descending, in proportion to the superincumbent pressure; and “That experimental research tends to show that a limit is soon reached beyond which the compression or increase of density becomes less and less in proportion to the force employed.”

Do not the estimates of hypothetical increased central density fail to consider the influence which the spherical form of the earth would have in counteracting accumulating pressure, and diverting the force of gravitation to a direction parallel with the circumference?

The case seems strictly analogous to that of an arch, in which the resulting force of gravitation is diverted along the arch to the abutments. If the earth is hypothetically assumed to be made up of a series of concentric hollow spheres (see Woodcut) A, B, C, D, it will be at once evident that each of such spheres would be self-supporting, just as in the case of a bridge, the addition of each successive course of brickwork composing the arch adds no pressure to, but rather increases, the resisting power of the single course first laid; the direction of the resistance of the gravitation of the mass being accumulated on the spring of the arch. Again, if we go on filling up this arch internally with successive courses of brickwork, we do not interfere with the stability of the external arch, neither is the weight of the first structure borne by the inner courses; in fact every zone of the arch or sphere is individually self-supporting. The *vertical* pressure of gravitation, which in successive superimposed layers of a plane would *accumulate*, is vertically neutralized in a sphere, and instead of getting the *sum* of the weight of the con-



centric layers, the independent pressure of each successive course is diverted in a line parallel with the circumference. To carry out the analogy we have merely to suppose two such semicircular arches, E F E and E D E, placed base to base in contact; the balance of resistance is completed, and we get a perfect epitome of the equilibrium of gravitation in the crust of the earth. Will not this satisfactorily explain the point noticed by Mr. Forbes, that the actual density of the earth falls short of its calculated density, on the estimate of the *accumulation* of superincumbent pressure? and will not the lateral pressure, analogous to that existing between the voussoirs of an arch, account for the horizontal force which seems to have operated in the production of Slaty Cleavage?

GEORGE MAW.

BENTHALL HALL, BROSELEY,
Feb. 10th, 1868.

I.—THE GRAPTOLITES OF THE SKIDDAW SERIES, ETC.

II.—ON THE CLASSIFICATION OF GRAPTOLITES.

SIR,—1. In the GEOLOGICAL MAGAZINE for January (p. 32), an abstract is given of my paper on the Graptolites of the Skiddaw Series, read before the Geological Society, December 4th, 1867.

As the generic characters of *Dichograpsus* are therein mis-stated, I should be glad if you will allow me to correct the error,¹ since I observe that it has been reproduced in a recent paper on Graptolites.

The presence of a corneous cup does *not* form a character of the genus *Dichograpsus*, since it is present in some species of the genus, and is uniformly absent in others. It likewise occurs in some *Tetragrapsi*, whilst it is never found in others, as *T. bryonoides*, Hall, and *T. quadri-brachiatus*, Hall. Lastly, it is occasionally found in some *Diplograpsi*, as *D. bicornis*, Hall. As the remainder of the definition of the genus is also incorrectly stated, I may be permitted to add that *Dichograpsus* is sufficiently defined by “the possession of a frond composed of a variable number (always more than four) of simple stipes, arising from a central non-celluliferous stem or funicle. The stipes are monopronidian, and are given off from the funicle in a radiating manner.”

II.—As a recent paper of mine on Graptolites (Ann. and Mag. Nat. Hist. Jan. 1868) has formed the subject of a somewhat lengthy criticism by Mr. W. Carruthers, in the GEOLOGICAL MAGAZINE for February, (p. 64), I trust you will afford me space for a reply. For the sake of brevity as well as clearness, I will notice such points as I may think necessary, in the order in which they occur in Mr. Carruthers' paper, premising that I have no intention of criticising, and shall simply touch upon such points as concern me personally.

1. Mr. Carruthers finds fault with me for “summarily” dismissing the Polyzoa, and for asserting that they “have, as a rule, a more or less calcareous test, and the individuals forming the compound organism are not united by any organized connecting substance.”

¹ The abstract here referred to, is furnished by the Assistant Secretary of the Geological Society, and is merely reproduced in the GEOLOGICAL MAGAZINE.—EDIT.