

ulate those states of union, preventing or separating some, favouring and effectuating others: and this cannot be without Chemical knowledge. In the production of geological formations and their subsequent changes of position, the common law of gravitation and other regular modes of attraction and repulsion, have performed and are always performing an important part: the investigation of those modes of action cannot be attempted, with the least hope of success, but by the application of mathematical Dynamics. The larger number of the earthy and stony masses which we have to study contain, in immense multitudes, the skeletons, the coverings, whether adherent integuments or such as supply the place of habitations, and various other remains of animals; and the substance, or mineral matter moulded upon the substance, of vegetable species, trunks, stems, leaves, and fruits: it is therefore indispensable to the right understanding of geological facts, that a competent knowledge should be obtained of Zoology and Comparative Anatomy, and of Botany according to a Natural System.* It must further be remarked, that the best books and the richest cabinets are not sufficient to convey complete ideas; but to closet-study must be added personal inspection of the face of a country, of sea-cliffs and beaches, of mountain-sides, rocky precipices, land-slips, and ravines; besides every kind of artificial excavation; and this labour, in travelling and exploring, must be carried to an extent greater

* "It is now admitted on all hands, that no man can be qualified to enter any of the highest walks of science, who is acquainted with only one branch of natural knowledge; and the mutual dependence of them all is now so positively demonstrated, that the philosopher of our days can no longer be allowed to remain satisfied with those inquiries which belong exclusively to any single branch, but must extend his investigations over the whole range of sciences, and illuminate his path by the varied combinations of them all." Prof. Buckland's *Vindiciæ Geologicæ*; his Inaugural Lecture, 1819; p. 10.