If we sufficiently keep in view that the crust of the globe with which we are acquainted, does not exceed, in comparative thickness, that of a wafer to an artificial globe three feet in diameter; and that a very large portion of the globe is now or has in ancient times been rent and pierced through by active volcanoes, and that these volcacanoes are not the seat of subterranean fire, but merely its chimneys, we shall have no difficulty in admitting, that extensive parts of the crust of the globe, far distant from any present volcanoes, may have been softened by internal heat, and the more fusible beds partly crystallized *in situ*, under the pressure of the ocean.

With respect to the overlying formations which pass by gradation into primary rocks (as some porphyries allied to volcanic rocks pass into granite), this fact, so far from proving that the porphyry was not of igneous origin, tends strongly to confirm the hypothesis, which attributes an igneous formation to granite itself.* It is granted by the best observers, that a regular gradation may be traced between granite and the more ancient volcanic rocks, and that there is likewise a gradation between the products of ancient and recent volcanoes, of which we shall afterwards treat more fully. It will be proper, before we proceed, to state the mineral composition of trap rocks. Felspar and hornblende, (see Chap. III.,) constitute the principal ingredients of trap; in many trap rocks the mineral called augite is intermixed with felspar: indeed, hornblende and augite resemble each other so much in chemical composition, and, when uncrystallized, in external character also, that they have till recently been confounded together, and they often occur together in the same rock. These compounds of felspar and hornblende, and felspar and augite, chiefly form the different rocks called greenstone, sienitic greenstone, basalt, clinkstone, pitchstone, wacke, and amygdaloid; and also trap-porphyry, and pitchstone-porphyry. All these rocks may be regarded as different modes and combinations of felspar with hornblende or augite, differing chiefly in their internal structure.

When hornblende and felspar are intermixed, and have a granitic structure, they form what is generally called greenstone; and if the felspar be red, sienitic greenstone. When hornblende and felspar,

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* However highly and justly distinguished many of the natural philosophers in France may be, it cannot be denied that they adhere more closely to theories once formed, and have a greater dread of thinking for themselves, than the philosophers of other countries. In confirmation of this, I shall translate an extract from M. Bonnard's *Aperçu Géognostique des Terrains*. It is truly amusing to see the alarm which he evinces, lest he should be compelled by stubborn facts to relinquish his cherished theories. "Another species of difficulty should prevent every prudent man (*esprit sage*) from attempting to explain the formation of these rocks of trachyte by any hypothesis founded on volcanic action; namely, the alarming extent of the consequences which may follow such an explication, relative to other rock formations, hitherto regarded as having a very different origin." With great respect for M. Bonnard, I would say, Let every *esprit sage* yield to the evidence which Nature presents, and leave consequences and theories to take care of themselves.