

the composition of the volcanic and plutonic rocks, as well as from such chemical experiments as those of Daubrée and of Tilden and Shenstone.¹

(4) The interior sub-crust is not perfectly homogeneous, but may be roughly divided into two layers or magmas, as they have been called: an upper, highly siliceous or acidic, of low specific gravity and light-coloured, and corresponding to such kinds of plutonic and volcanic rocks as granite and trachyte; and a lower, less siliceous or more basic, more dense, and more highly charged with iron, and corresponding to such igneous rocks as the dolerites, basalts, and kindred lavas. It is interesting here to note that this conclusion, elaborated by Durocher and von Waltershausen, and usually connected with their names, appears to have been first announced by John Phillips, in his 'Geological Manual,' and as a mere common sense deduction from the observed phenomena of volcanic action and the probable results of the gradual cooling of the earth.² It receives striking confirmation from the observed succession of acidic and basic volcanic rocks of all geological periods and in all localities. It would even seem, from recent spectroscopic investigations of Lockyer, that there is evidence of a similar succession of magmas in the heavenly bodies, and the discovery by Nordenskiöld of native iron in Greenland basalts, affords a probability that the inner magma is in part metallic.³

(5) Where rents or fissures form in the upper crust, the material of the lower crust is forced upward by the pressure of the less supported portions of the former, giving rise to

¹ *Phil. Trans.* 1884. Also Crosby in *Proc. Boston Soc. Nat. Hist.* 1883.

² Phillips, *Manual of Geology*, 1855, p. 493. Dr. Sterry Hunt has kindly directed my attention to the fact of Phillip's right of priority in this matter. Durocher in 1857 elaborated the theory of magmas in the *Annales des Mines*, and we are indebted to Dutton, of the United States Geological Survey, for its detailed application to the remarkable volcanic outflows of Western America.

³ These basalts occur at Ovífak, Greenland. Andrews has found small particles of iron in British basalts. Prestwich and Judd have referred to the bearing on general geology of these facts, and of Lockyer's suggestions.