the one end we find basalts or diabases and picrites, followed sometimes by copious outpourings of andesites, while at the other end come intrusions of felsites and quartz-porphyries. Again, among the Tertiary lavas, the basalts of the great plateaus are pierced by bosses and dikes of granophyre and allied acid rocks. In these various examples the facts point to some gradual change in the composition of the subterranean magma during the lapse of a single volcanic period—a change in which there was a separation of basic constituents and the discharge of more basic lavas, leaving a more acid residuum to be erupted toward the end of the activity.[168]

§ 5. Causes of Volcanic Action

The *modus operandi* whereby the internal heat of the globe manifests itself in volcanic action is a problem to which as yet no satisfactory solution has been found. Were this action merely an expression of the intensity of the heat, we might expect it to have manifested itself in a far more powerful manner in former periods, and to exhibit a regularity and continuity commensurate with the exceedingly slow diminution of the earth's temperature. But there is no geological evidence in favor of greater volcanic intensity in ancient than in more recent periods; on the contrary, it may be doubted whether any of the Palæozoic volcanoes equalled in magnitude those of Tertiary and perhaps even post-Tertiary times. On the other hand, no feature of volcanic action is more conspicuous than its spasmodic fitfulness.[169]

As physical considerations negative the idea of a com-

[168] Quart. Journ. Geol. Soc. vol. xlviii. (1892), p. 177.

[169] Consult Dana, "Characteristics of Volcanoes," p. 15 *et seq.* Dutton, U. S. Geol. Rep. 1882–83, p. 183 *et seq.* Prestwich, Proc. Roy. Soc. xli. (1886), p. 117. Löwl, Jahrb. Geol. Reichsanst. 1886, p. 315.