subterranean commotions, although it must be admitted that earthquakes and volcanic eruptions re-act in their turn upon the atmosphere, so that disturbances of the latter are generally the consequences rather than the forerunners of volcanic disturbances.*

From an elaborate catalogue of the earthquakes experienced in Europe and Syria during the last fifteen centuries, M. Alexis Perrey has deduced the conclusion that the number which happen in the winter season preponderates over those which occur in any one of the other seasons of the year, there being, however, some exceptions to this rule, as in the Pyrenees. Curious and valuable as are these data, M. d'Archiac justly remarks, in commenting upon them, that they are not as yet sufficiently extensive or accordant in different regions, to entitle us to deduce any general conclusions from them respecting the laws of subterranean movements throughout the globe.†

Permanent elevation and subsidence. — It is easy to conceive that the shattered rocks may assume an arched form during a convulsion, so that the country above may remain permanently upheaved. In other cases gas may drive before it masses of liquid lava, which may thus be injected into newly opened fissures. The gas having then obtained more room, by the forcing up of the incumbent rocks, may remain at rest; while the lava congealing in the rents, may afford a solid foundation for the newly raised district.

Experiments have recently been made in America, by Colonel Totten, to ascertain the ratio according to which some of the stones commonly used in architecture expand with given increments of heat.‡ It was found impossible, in a country where the annual variation of temperature was more than 90° F., to make a coping of stones, five feet in length, in which the joints should fit so tightly as not to admit water between the stone and the cement; the annual contraction and expansion of the stones causing, at the junctions, small crevices, the width of which varied with the nature of the rock. It was ascertained that fine-grained granite expanded with 1° F. at the rate of ·000004825; white crystalline marble ·000005668; and red sandstone ·000009532, or about twice as much as granite.

Now, according to this law of expansion, a mass of sandstone, a mile in thickness, which should have its temperature raised 200° F., would lift a super-imposed layer of rock to the height of ten feet above its former level. But, suppose a part of the earth's crust, one hundred miles in thickness and equally expansible, to have its temperature raised 600° or 800°, this might produce an elevation of between two and three thousand feet. The cooling of the same mass might afterwards cause the overlying rocks to sink down again and resume their original position. By such agency we might explain the gradual rise of Scandinavia or the subsidence of Greenland, if

* Scrope on Volcanos, pp. 58—60.

† Archiac, Hist. des Progrés de la Géol. 1847, vol. i. pp. 605—610.

‡ Silliman's American Journ., vol. xxii. p. 136. The application of these results to the theory of earthquakes was first suggested to me by Mr. Babbage.