

crumpled. The work effected by the compression and movement of the rocks is transmuted into heat, and under local conditions of concentration of the movements or sudden cessation and relief of pressure, the temperature of the crushed rocks may arrive at the point of actual fusion. If interstitial or descending surface-water be absorbed by the glowing rock-masses in sufficient quantity, its conversion into steam at any moment of diminished pressure may give origin to explosive volcanic phenomena at the surface. These are the general arguments in Mallet's theory of volcanicity, which was strengthened by the author's elaborate series of experimental researches on the stresses required to crush different varieties of rock, and the amount of heat that would be produced in each case by this mechanical means.

Mallet's theory has been contested by Justus Roth in Germany and by Poulett-Scrope and Fisher in England. But certain ideas in it, such as the steady contraction of the earth's nucleus and its tendency to shrink away from an unequally yielding crust, have proved distinctly valuable in the consideration of the earth's physics, and have been variously applied by later authors.

Most geologists at present look sceptically upon any theory which derives volcanic action from the conversion of dynamical energy into heat during crust-movements. Present opinion associates volcanic phenomena with the primitive internal heat of the earth, and supposes rock-magma to be embodied in a state of fusion within the earth's mass. This was likewise the broad conception of volcanicity which was held by the ancient philosophers, and by Athanasius Kircher, Steno, Buffon, Dolomieu, Spallanzani, Faujas de Saint-Fond, Von Humboldt, Von Buch, Poulett-Scrope, Daubeny, and Lyell.

The actual protrusion of subterrestrial magmas into the earth's crust or at the surface was attributed by Cordier, Constant Prévost, and Dana to the cooling of the earth's crust and the pressure which it therefore exerts upon the nuclear mass. Professor Suess has applied the distinctive term of "batholite" to an older massive protrusion of magma solidified as coarse crystalline rock in the deep horizons of the crust. In 1888, the same geologist in his famous work, *Der Antlitz der Erde*, discusses the conditions which determine the particular form of igneous protrusion, whether as deep-