

The founder of the newer theories of upheaval was without doubt James Hutton, the Scottish geologist. According to Hutton, the earth's internal heat caused the rocks to expand and to find relief by bulging upward; thus portions of the earth's surface rose above sea-level and formed continents and mountains; volcanoes provided a means of exit for the hot vapours and molten masses of rocks, and prevented the excessive expansion and upheaval of the earth's crust. Although Hutton's theory of expansion and elevation was at first little considered, a number of observers like Fichtel and Pallas arrived at similar conclusions from independent researches, while De la Beche, Babbage, Lyell, and Poulett-Scrope accepted the theory and extended it in various directions.

Leopold von Buch was an enthusiastic supporter of the Huttonian theory. In the year 1812, J. L. Heim had assigned to basalt an important rôle in the elevation of mountain-chains. Von Buch ten years later, after his studies in South Tyrol, became convinced that the dolomite was an altered limestone, the transformation having been effected by the action of volcanic magnesian vapours during the protrusion of augite porphyry. From the stratigraphical relations of the sedimentary rocks and their association with the augite porphyry, Buch developed his well-known theory that the whole Alpine system followed the direction of an enormous fault, through which augite porphyry had locally escaped at the surface, and had elevated, tilted, and folded the neighbouring rocks. The results obtained in South Tyrol were then applied to Thuringia and the Harz, and finally the hypothesis was expressed that all mountain-chains had been upheaved by augite porphyry.

The disciples of Buch found in the theory of eruptivity and consequent disturbance of strata a complete explanation of all possible complications of crust-deformation, and for a time the upheaval of mountains was ranked as a volcanic phenomenon. Poulett-Scrope in 1825, in his work *On Volcanoes*, supported Hutton's Plutonic doctrine, and entered into an elaborate investigation of the ascent of intrusive granite and porphyritic masses in relation to the tectonical effects produced upon the different kinds of rock-strata which might happen to be in the neighbourhood.

A Swiss geologist of note who shared Buch's views on mountain-upheaval was Bernhardt Studer; he explained the