

tritus has been laid down upon it, and where, consequently, the crust has been softened and depressed. We must beware, in this connection, of exaggerated notions of the extent of contraction and of crumpling required to form mountains. Bonney has well shown, in lectures delivered at the London Institution, that an amount of contraction, almost inappreciable in comparison with the diameter of the earth, would be sufficient; and that, as the greatest mountain chains are less than $\frac{1}{600}$ th of the earth's radius in height, they would, on an artificial globe a foot in diameter, be no more important than the slight inequalities that might result from the paper gores overlapping each other at the edges. This thinness of the crushed crust agrees with the deductions of physical science as to the shallowness of the superficial layer of compression in a cooling globe. It is perhaps not more than five miles in thickness. A singular proof of this is seen by the extension of straight cracks filled with volcanic rock in the Laurentian districts of Canada.¹ The beds of gneiss and associated rocks are folded and crumpled in a most complex manner, yet they are crossed by these faults, as a crack in a board may tear a sheet of paper or a thin veneer glued on it. We thus see that the crumpled Laurentian crust was very thin, while the uncrushed sub-crust determined the line of fracture.

(7) The crushing and sliding of the over-crust implied in these movements raise some serious questions of a physical character. One of these relates to the rapidity or slowness of such movements, and the consequent degree of intensity of the heat developed, as a possible cause of metamorphism of rocks. Another has reference to the possibility of changes in the equilibrium of the earth itself, as resulting from local collapse and ridging. These questions in connection with the

¹ As, for instance, the great dyke running nearly in a straight line from near St. Jerome along the Ottawa to Templeton, on the Ottawa, and beyond, a distance of more than a hundred miles.