

The Formation of Mountains

THE quotation given by Mr. Wallace from the English Cyclopædia affords a sufficient basis to prove "the more rapid [present] cooling of the interior of the globe than of the crust." I will add a passage from Sir W. Thomson's "Secular Cooling of the Earth," of a like tendency: "I think it cannot be denied that a large mass of melted rock, exposed freely to our air and sky, will, after it once becomes crusted over, present in a few hours or a few days, or at most a few weeks, a surface so cool that it can be walked over with impunity. Hence, after 10,000 years, or, indeed, I may say a single year, its condition will be sensibly the same as if the actual lowering of temperature experienced by the surface had been produced in an instant, and maintained constant ever after."¹

¹ *Trans. R.S. Edin.*, 1862; also Thomson and Tait's "Nat. Phil.," App. D.

This constant temperature of the surface having been once established, the internal parts would be hotter than the crust, and their heat must then necessarily, by the law of conduction, pass from the hotter to the cooler region, and so into and through the crust, and be radiated away from the surface into space, the kind of action which I illustrated in my former letter by the dispersion of a crowd. Thus the interior would tend to fall to the already established temperature of the surface, and thenceforth tend to cool more rapidly than the "crust." For the nearer a stratum lies to the surface, the less cooling will be requisite to bring it down to the temperature of the surface. To take the extreme case; after the lapse of an infinite time the whole globe would eventually become of the temperature which the surface assumed at that already far-distant epoch, and has maintained ever since.

When the superficial strata had early assumed their nearly permanent temperature, they will concomitantly have attained a corresponding permanent volume, which will afterwards have proved too large for the cooling interior, so that they must, in subsiding, have become wrinkled. To this extent, then, I think Mr. Wallace's objections are untenable. Here, however, enters the question, so difficult to answer in nearly all geological problems, of "How much?" For my part, I think I have proved that the mere cooling, though a *vera causa*, would not be of itself a sufficient cause to account for the inequalities existing now, at what must be, judging by the enormous store of heat still within the earth, a comparatively early stage of the cooling.¹

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Harlton, Cambridge, January 18

¹ Cambridge *Phil. Trans.*, vol. xii. part 2.