

## LETTERS TO THE EDITOR.

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## Lord Kelvin on the Origin of Granite.

IN 1897 Lord Kelvin delivered an address to the Victoria Institute on the age of the earth, Sir G. G. Stokes being in the chair. Incidentally, the address included theories of the origins of granite, basalt and continents, and touched on the question of the inclusion of gases in various rocks.

At the late meeting of the British Association two sectional Presidents referred to Lord Kelvin's theory, both apparently accepting his lordship's conclusions without noticing his premisses.

My old master, William Pengelly, used to teach that as every theory depended on many facts, if but one fact were disproved the theory fell to the ground. From this aspect there are several points in Lord Kelvin's theory which seem to require elucidation.

Lord Kelvin starts from a period in the earth's evolution when a lava ocean forty kilometres deep covered a solid nucleus. The specific gravity of the liquid lava is assumed to be 2.50. It is also assumed, on what seem firm grounds, that solid lava would sink in fluid lava, and on more doubtful grounds, that all minerals crystallising out of lava would also sink. On this assumption the lava ocean silts up, and the surface does not "freeze" until the forty kilometres of the crust (excepting the future ocean basins) are composed of solid crystals set in an interstitial mother liquor.

According to Lord Kelvin, continents arose from the drifting and unequal distribution of the crystals falling like a "snow shower" through the lava; the ocean basins arising from the contraction of the mother liquor in cooling. The theory is brilliantly unfolded, but there are many technical difficulties, e.g. Lord Kelvin's granite, besides being an exclusively primeval rock, is composed of drifted crystals of felspar, mica, quartz and hornblende (or some of them) set in a basaltic matrix. The ultimate mother liquor is made to serve the purpose both of basalt and of the matrix of granite. One gas at least, viz.  $C.O_2$ , treated as original in basalt, might well arise from the calcite which so often occurs in that rock. But the most serious and far-reaching difficulty is involved in the specific gravity of lava minerals. Assuming the liquid lava to be 2.50, there are several minerals which would float in such an ocean, and if there were but one, it would suffice to provide a floating crust or slag which would blanket the glowing lava and entirely upset all heat calculations based on the consolidation of the earth from within to without.

What perplexes me in the matter is that so many philosophers who accept Lord Kelvin's conclusions hold themselves at liberty to reject his premisses.

For instance, the President of Section E, while declaring his adhesion to Lord Kelvin's time-views as against the geologists, entirely ignores both his continental theory and the main premiss as to the specific gravity of the lava ocean. Lord Kelvin assumes the lava to be 2.50, while Sir John Murray assumes the crust to be 2.50, a most fundamental distinction.

Petrologists have fought desperately over the question of the origin of granite, but so far as I am aware they are agreed on all the main points.

I believe myself that every known fact fits most exactly into the grand working hypothesis that granite is a plutonic rock formed by hydrothermal action and pressure out of a previously existing rock, which consisted in the first place of those light aluminous soda and potash silicates which first consolidated on the surface of the primeval lava ocean. To these silicates we have but to add water, in order to form (so far as constituents go) a typical muscovite granite—absolutely nothing more; indeed, less, as we may omit the soda. The constituents of muscovite ( $K_2O, 2H_2O, 3Al_2O_3, 6SiO_2$ ) are simply leucite ( $K_2O, Al_2O_3, 4SiO_2$ ) and water. Introduce sodalite, an even more likely constituent of the primeval crust than leucite, and we have all our materials for ordinary granites, except magnesia, with which, however, Lord Kelvin supplies us by means of eruptions of the basaltic mother liquor.

This is but a working hypothesis, but it will work; whereas

Lord Kelvin's novel theory throws the whole problem of granite into inextricable confusion, even starting from the hopeless position of disagreement as to what the term granite denotes, geologically, mineralogically and petrologically.

The whole question seems to turn on one single point, viz. whether the first primeval crust when cold floated on the subjacent lava. According to the elements of mineralogy it would do so; but many physicists have assumed that upon consolidation it would sink. Will not some of the distinguished specialists in mineralogy and petrology pronounce judgment on this question, which is really troubling unlearned and ignorant men who are genuinely seeking information? The conflict of authority is quite overwhelming.

A. R. HUNT.

Torquay, February 13.

## Effects of Lightning upon Electric Lamps.

I HAVE often seen luminous trails, similar in appearance to those shown in Mr. Webb's photographs (p. 343), in photographs taken at night. That there are any effects in these or Mr. Webb's pictures that cannot be explained by a moving camera, I am unable to convince myself of. The identical form of the discharges from different lamps has been explained by the distance of the discharge causing them. Granting that it is possible to have a discharge, so intricate in character, exactly duplicated at a second lamp (which is scarcely conceivable), their magnitudes in the pictures should be inversely proportional to their distances. But we find that, in the pictures, the scrawls are all of the same size. A lamp close to the camera, and a distant lamp, show the trails on the same scale.

The beading of the trails can be easily explained by the alternations of the current, the carbons fluctuating in brilliancy. I am informed that in Dover these periodic fluctuations are very conspicuous. Where a trail turns suddenly, the beads are closer together, due to the motion of the camera being slower when the direction of motion is about to change.

If I remember right, there are one or two cases where we have a very large and brilliant pattern, and several similar ones on a smaller scale. This could be explained by reflection from the inner surfaces of the lens.

R. W. WOOD.

London, February 20.

## The Fitting of the Cycle to its Rider.

I HAVE read Mr. Hutchins's communication (p. 368) with considerable interest. Mr. Hutchins is at the head of the Forest Department which has been recently established by the Cape Government, and the improved method of riding that he has adopted, in accordance with the views expressed in my recent paper, have evidently been of service to him in traversing the very rough country to enable him to carry out his duties. Mr. Hutchins's experiences so closely agree with my own that I can say little in criticism of his letter. I think, however, that he will find that the gain from the lengthened crank advocated by me cannot be explained by the very simple formula that he gives. My son and I went very carefully into this matter at the time I prepared my paper, and I think if Mr. Hutchins refers to it he will find, if we consider the mechanical advantage apart from the gain in nerve waste, the mathematical analysis of anking given by lengthened crank both give the only explanation which would be satisfactory to a mathematician. In our explanation the weight of the leg plays a very important part, and it follows therefore that a heavy legged man gets most from our system of riding.

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THE point raised by Mr. Hutchins in his letter (p. 368) is worth considering, but Mr. Crompton, who by his wonderful riding has done so much to popularise the use of the long cranks first suggested by Mons. Boulay, is not heavily built. A man who is over fifty cannot move his legs so quickly as when he was younger; and so middle-aged persons, stout or slim, profit greatly by using long cranks and high gears. Most people when in a hurry run upstairs two steps at a time, and bicyclists, whether in a hurry or not, find it an advantage to raise gears and lengthen cranks.

The question is, how far may we go without unduly increasing the weight of our bicycles?

My age is fifty-one, weight 15 stone, height under 6 ft., and,