good an idea from a word picture as from a photograph, and it was of the utmost assistance in the making of maps. Photography in its application to the art of the cartographer would free us from the great liability of making errors.

The President pointed out that the Jungfrau had been surveyed and its contour outlined by means of photography. The photographic process of survey had been tested, and had been found most efficient, particularly where the ordinary surveyor had to deal with places which were inaccessible.

LUNAR AND TERRESTRIAL VOLCANOES.*

BELIEVING the trap-dyke theory to be the most plausible explanation, we would like to ask whether, in spite of no shadows having yet been detected, the rays may not be due after all to *slight ridges* of igneous rock welling out in a viscous state from long cracks, and so catching a little more light than the surrounding parts of the lunar surface. Such ridges might be no more than 100 or 200 feet in height, and if their sides slope gradually it might be impossible to detect their shadows. We may also suppose they consist of some light-coloured trap-rock, such as felstone, and to be "weathered" by the lunar atmosphere, thus presenting a somewhat whitened surface. It is quite possible that the lunar trap-rocks may be of a highly siliceous nature, like "volcanic glass," also that they may have been considerably weathered and whitened by the action of great quantities of steam, now absorbed by the moon, emitted in the last phases of lunar volcanic action. We know that steam can act chemically on glass, and turn it white. The lunar photograph in Mr. Ranyard's paper shows that the streaks are not nearly so bright as some mountains and craters, but this would easily be accounted for by the very great difference in height. Our idea is that the lunar mountain ranges are composed of volcanic rocks thrown up in some way from lines of fissure, and that the streaks are, as it were, attempts at lunar mountain ranges, which failed because, for some reason, the lava was not forced up in sufficient quantity. We rebel, for several reasons, against the idea of the lunar mountains being covered with snow. For instance, there is a great difference in the whiteness of different lunar mountains, which would be impossible if snow were the cause of the whiteness. But if they are composed of different kinds of trap-rock, it is extremely likely that they would weather differently, so that some might be whiter than others. Those, like basalt, of a more basic character (*i.e.*, with more lime and magnesia) would be of a darker colour, while others, like felstone (which is acidic and contains much free silica), would be of a lighter hue.

In looking over the beautiful pictures in Messrs. Nasmyth and Carpenter's book, we notice another point which seems to favour this idea—namely, that short lines of mountains are so often seen in connection with lunar craters, sometimes roughly radiating from them, sometimes all more or less in one direction. We observe this especially in the pictures of Gassendi (the frontispiece), Copernicus, Archimedes, Aristotle and Eudoxus, Trisnecker, Plato, Mercator, and Campanus, and also very plainly in the photo of Aristarchus and Herodotus. Again, the occurrence of craters in lines, in some cases, is another important fact tending to confirm this idea. (It will be remembered that terrestrial volcanoes run very markedly in lines.) It may be well here to quote the authors above referred to. They say (p. 98): "We have upon the moon evidence of volcanic eruptions being the final result of most extensive dislocations of surface, such as could only be produced by some widely diffused, uplifting force. We allude to the frequent occurrence of chains and craters lying in a nearly straight line, and of craters situated at the converging point of visible lines of surface disturbance. Our map will exhibit many examples of both cases. An examination of the upper portion (the southern hemisphere of the moon) will reveal abundant instances of the linear arrangement. Three, four, five, or even more crateral circles will be found to lie with their centres upon the same great-circle track; proving almost undoubtedly a connection between them, as far as the original disturbing force which produced them is concerned. Again, in the craters Tycho, Copernicus, Kepler, and Proclus, we see instances of the situation of a volcanic outburst at an obvious focus of disturbance."

On this theory, the dark linear markings on the moon, known as "hills" or "clefts," are probably cracks up which, for some reason, the molten matter only welled-up to some point below the surface. Perhaps they formed later than other terrestrial features, after the volcanic fires had died out, and when the linear surface was losing its old heat rapidly, and therefore cracking as it contracted on cooling.

It must be confessed that there is little to be said in favour of the view that the lunar streaks have been produced in a similar way to terrestrial "faults," for several reasons: First—the mountains of the moon, as far as we can see, are different to terrestrial mountains, and seem to be entirely volcanic, whereas our mountains are mostly due to the upheaving and folding of sedimentary strata; their present outlines being the result of long-continued atmospheric denudation. Secondly—it seems to me impossible, in the present state of our knowledge, to say whether stratified rocks are present on the lunar surface. If at one time there were seas, and an atmosphere at all like ours, "denudation" must certainly have taken place, and that would involve the accumulation of marine sedimentary deposits. Many believe that there is evidence of stratification, and even of tilted strata, in the lunar Apennines; but if this is the case, I should prefer to consider such strata as purely volcanic, viz., lava and ashes. Thirdly—terrestrial "faults" are very sharp lines of division, like the cracks which form in a sheet of ice after continued skating, so that we could not expect to see them.

One word in conclusion about "trap-dykes." These are veins of eruptive rock (basalt, &c.) filling up vertical or highly inclined fissures, and are so named on account of their resemblance to walls (*Scottice*, dykes). When the surrounding rock has decayed, the dykes may be seen projecting above ground exactly like walls. Sometimes the eruptive rock has followed the course of a "fault"; but in Scotland, at least, the vast majority of dykes rise along ordinary fissures which, having caused no displacement, cannot be considered as "faults." On the contrary, the dykes may be traced undeflected across some of the largest "faults." Dykes differ from veins in the greater parallelism of their sides, their verticality, and greater general regularity. Usually a dyke cannot be traced far, but the well-known Cleveland Dyke, in the north of England, runs for at least 60 miles, cutting through various "formations" till it reaches the Yorkshire coast,

* Concluded from page 598.