At a later stage, when the crust, having hitherto cooled more rapidly than the interior, began to have a slower rate of cooling, the retreating nucleus left the crust to contract upon it, corrugating in the process, and so forming the first mountain ranges upon the spheroidal earth, which preceding processes had left partially deformed and therefore ready to become in due time divided into oceans and continents.

At this stage the earth must have been surrounded by an atmosphere much denser than that now existing, and more complex in constitution. We may probably form the most trustworthy opinion of the earth's atmosphere and the probable condition of the earth's surface at this early epoch by following the method of reasoning employed by Dr. Sterry Hunt. It will be remembered that he conceives an intense heat applied to the earth as at present existing, and infers the chemical results. It is evident that such a process would result in the oxidation of every form of carbonaceous matter; all carbonates, chlorides, and sulphates would be converted into silicates,—carbon, chlorine, and sulphur, being separated in the form of acid gases. These gases, with nitrogen, an excess of oxygen, and enormous quantities of aqueous vapour, would form an atmosphere of great density. In such an atmosphere condensation would only take place at a temperature far above the present boiling point; and the lower level of the slowly cooling crust would be drenched with a heated solution of hydrochloric acid, whose decomposing action, aided by its high temperature, would be exceedingly rapid. The primitive igneous rock on which these heavy showers fell, probably resembled in composition certain furnace-slags of basic volcanic gases. Chlorides of the various bases would be formed, and silica would be separated under the decomposing action of the heated showers until the affinities of the hydrochloric acid were satisfied. Later, sulphuric acid would be formed in large quantities by the combinations of oxygen with the sulphurous acid of the primeval atmosphere. After the compounds of sulphur and chlorine had been separated from the air, carbonic acid would still continue to be an important constituent of the atmosphere. This constituent would gradually be diminished in quantity, during the conversion of the complex aluminous silicates into hydrated silicate of alumina, or clay, while the separated lime, magnesia, and alkalies would be changed into bicarbonates, and carried down to the sea in a state of solution.

Thus far the earth was without life, at least no forms of life, vegetable or animal, with which we are familiar, could have existed while the processes hitherto described were taking place. The earth during the long series of ages required for these changes was in a condition comparable with the condition through which Jupiter and Saturn are apparently at present passing. A dense atmosphere concealed the surface of the earth, even as the true surface of Jupiter is now concealed. Enormous cloud masses were continually forming and continually pouring heavy showers on the intensely heated surface of the planet, throughout the whole of the enormous period which elapsed between the time when first the earth had a surface and the time when the atmosphere began to resemble in constitution the air we breathe. Even when vegetable life, such as we are familiar with, was first possible, the earth was still intensely heated, and the quantity of aqueous vapour and cloud always

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formed, yet some of the smaller craters in these lunar regions where craters overlap like the rings left by raindrops which have fallen on a plastic surface, might be due to meteoric downfall. I find that Meyer had far earlier advanced a similar idea in explanation of those extensive regions of our earth which present signs of having been in a state of igneous fluidity. Again, two or three years ago, Sir W. Thompson startled us by suggesting the possibility that vegetable life might have been introduced upon our earth by the downfall of fragments of old worlds. Now, several years before, Dr. Sterry Hunt had pointed to evidence which tends to show that large meteoric globes had fallen on the earth, and he showed further that some meteors contain hydrocarbons and certain metallic compounds indicating processes of vegetation. Dr. Hunt tells me that, in his opinion, some of the meteors whose fragments have fallen on the earth in historic times were once covered with vegetation, since otherwise, according to our present chemical experience, the actual condition of these meteoric fragments would be inexplicable. He does not regard them as fragments of a considerable orb comparable even with the least of the planets, but still, whatever their dimensions may have been, he considers that vegetable life must have formerly existed upon them.