ON THE GEOLOGICAL PHENOMENA OF THE SOLAR SYSTEM.

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We admit a similar geological (or chemical) constitution for the various bodies of the solar system, and from this conclude that the phenomena which have accompanied their formation and their successive transformations, must have been similar. Thus the planets and satellites whose density is near to that of our earth may be supposed to have passed through the different stages of liquid and solid incandescence, of the successive liquefaction of portions of their gaseous envelopes, and to have finally been the seat of an organic creation.

Of these planetary bodies the best known to us is the moon, and we shall now inquire to what extent our slight knowledge of it is in accordance with the observations made on our earth, and w th the present state of the sun as supposed by Mr. Leverrier. It is well known that astronomers, so soon as they became possessed of good telescopes, discovered mountains and plains (or seas) on the surface of the moon, and the immediate application of these names shews the great resemblance which was supposed to exist between the surfaces of the moon and the earth. It does not appear surprising that the form of the lunar mountains should be met with among only a small number of those on our planet, and physicists easily explain the greater elevation and the steep declivities of the former by the comparatively feeble action of the centripetal force at the moon's surface. But one of the gravest objections to the idea of a common origin of the moon and the earth is the apparent absence of water and air from the surface of our satellite, thus seriously embarrassing those geologists who attribute terrestrial volcanic phenomena to the intervention of these expansible elements.

If however we admit for the earth and the moon an identical and simultaneous point of departure we can understand that their cooling has taken place at a rate nearly proportioned to their volume. That of the moon being about two hundredths the volume of the earth, its temperature, if we admit an equal conductibility, will have decreased with a rapidity fifty times greater, so that the geological epochs of the moon will have been in the same proportion shorter than the corresponding epochs on the earth, up to the time when the solar heat began to be an appreciable element. The moon has then advanced much more rapidly than the earth in the series of phenomena through which both must pass, and we may therefore logically suppose that our globe will one day offer the same general characters as are now presented by the moon.

We believe then that the waters which cover the surface of the earth and the air which surrounds it will one day disappear, as a necessary consequence of the complete cooling of the interior of our planet. Rocks, with few exceptions, readily absorb moisture, and the more crystalline varieties are the most porous; we need not, however, consider the quantity of water which rocks may imbibe in this way, for the total amount of this element on the earth's surface is so small when compared with the whole mass of the globe, that the ordinary processes of chemical analysis would not detect its presence. If we take the mean depth of the ocean at 500 meters* (=1968 feet), its weight will be equal to one twenty-four-thousandth of the earth, which being reduced to decimals, would give for 100 parts,

Earth	09·9958
Water	·0043

In the Bulletin of the Geol. Society of France, (2d series, vol. x., p. 131,) Durocher has published a series of experiments made to determine the quantity of water in those minerals which enter into the structure of rocks, such as the feldspars, micas, hornblende and pyroxene, and which are regarded as anhydrous in composition. These minerals were reduced to coarse powder and exposed to moist air, the proportion of water being determined both before and after; it will be sufficient for our purpose to give the amount of water found after exposure. The orthoclase of Utoë absorbed in this way 0·41 for 100 parts, while the mean of seven other varieties of the same species was 1·28, and that of thirty specimens of various substances 1·27. We have already seen that if the whole of the ocean were to be equally distributed throughout the earth this would contain only 0·0042, or 100 times less than the least hygrometric of the feldspars. It is probable that the water of the ocean thus absorbed would enter into chemical combination; at all events it would occupy a space much less than the pores produced by the shrinking of the rocks.

If, now, we attempt a similar calculation for the atmosphere, we find that in supposing a height of eight kilometers, the total volume of the air which surrounds our globe, brought to the density which it has at the surface, would be about four millions of cubic myriameters, the volume of the earth being equal to 1083 millions, or 270 times that of the air, so that a contraction of the primitive volume producing a vacuum of four thousandths ($\frac{1}{250}$) would be more than sufficient to absorb the whole of the atmosphere. (In calculating the volume of the atmosphere we have multiplied the surface of the globe in square myriameters, by 0·8, which gives a sufficiently accurate result, the more so that the density of the air in the interior of the earth will be everywhere greater than at the surface.)

From the preceding considerations, the sucessive absorption of the air and water by the solid portions of the globe becomes in the highest degree probable, and we may conclude that our earth will one day present that same total absence of ocean and atmosphere which we now remark in the moon. It is evident that this progress of the waters towards the earth's centre must have long been in operation, and it becomes interesting to consider the effect which this must have had upon the level of the ocean. Let us suppose that the rocks near to the surface of the earth contain one hundredth of water, a proportion which from the

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* This depth is deduced from the comparison of the relative areas of land and water which are taken as 1:3, the elevation and depression of the surface being assumed as proportional to the square roots of their surfaces. (Saigey, *Physique du Globe*, 232) The depth of the Pacific Ocean, as deduced by Bache from the earthquake wave of December, 1854, was about 13,000 feet.—(Note by the Editors of *Sillimans' Journal*.