

to consider as extinct in her the forces that are persistently manifested in our own planet. To prove that the moon also retains them has been, therefore, the eager ambition of modern astronomers. If they have given up, even from the days of Hudibras, the hope of ever becoming acquainted with those beings, who, according to the satirist,

"—live in caverns underground.
Of eight miles deep and eighty round."

they yet never despaired of detecting, in modifications of lunar features, the obvious proofs of recent volcanic action. Superficial changes, such as many that have occurred on the earth within a brief period might be easily noticed on the moon. Lava streams of forty or fifty miles in length, and ten or fifteen in breadth, like those that flowed from the Skaptá Jokul in 1783, would form very striking objects indeed; and, still more remarkable, with its lights and shadows, would be the elevation of a mountain like Jorullo, which rose sixteen hundred feet from the plain in 1759. But there has been no discovery of any such additions to the great lunar landscape, although, as already remarked, the disappearances of Linné are not the only observed phenomena of their kind; and, in a place previously hidden by a white cloud, Mr. Kuottli discovered two small craters in December, 1864. It is probable, however, that the present obscuration will turn out the most important that has hitherto been noticed, and the most instructive in the investigation of lunar physics.

In a letter published in the *Intellectual Observer*, January, 1867, Herr Schmidt describes the phenomenon as follows:—"For some time past, I find that a lunar crater situated in the *Mare Serenitatis* has been invisible. It is the crater which Mädler named Linné, and is in the fourth section of Lohrman under the sign A. I have known this crater since 1841, and even at the full it has not been difficult to see. In October and November, 1866, at its epoch of maximum visibility—i. e., about the time of the rising of the sun on its horizon—this deep crater, whose diameter is 5.6 English miles, has completely disappeared, and in its place there was only a little whitish luminous cloud." In a letter appearing in the *Astronomical Register*, March, 1867, he says that "not only is a crater never visible, but there appears in good light, and with magnifying powers from 300 to 600 at most, a very delicate hill of 300 toises diameter (1,918 4 English feet), and 5 or 6 toises (between 30 and 40 English feet) in height. As a crater, Linné has entirely disappeared."

"The light spot is always visible, but the crater-form has never been visible from October until the present time."

"January 25.—No crater, and the light cloud visible. In it (as on December 26) a very fine black point; to the west of it a fine white summit."

In a letter to the *Astronomische Nachrichten* (see translation in the *Astronomical Register*, May, 1867, by W. T. Lynn, Esq., B.A., F.R.A.S.), Schmidt says:—"At the time of the labours of Lohrman and Mädler, 1822-32, Linné was a deep crater more than 5,000 toises (6 English miles) broad, and very deep, distinctly visible as a crater; when near the phase, it was more or less overshadowed. . . . At least since 1866, October 16, the crater-form of Linné, at the time of oblique illumination, cannot at all be seen. The Athens refractor shows in the interior of its figure at times a fine black point 300 toises (1,918 4 English feet) in diameter."

It must be said that all this is not very clear, for it seems easier to consider the black point a depression than an elevation. In a letter from the Roman astronomer, Father Secchi, to the French Academy, he says:—"On the evening of the 10th (February) between nine and ten o'clock, the crater Linné entered into the sun's light, and close by the limiting circle a small prominent point was seen with a little shadow, and round this point an irregular circular corona very flattened. On the 11th, a very small crater was distinctly seen, surrounded by a brilliant white aureole, which glistened against the dark ground of the *Mare Serenitatis*. The size of the orifice of the crater was at most one-third of a second, and the aureole was a little larger than *Sulpicius Gallus*. I insist on this comparison because it shows that Beer and Mädler could never have figured a crater as big and as well-marked as that which they assigned to Linné for the white spot which at present exists. In fact, *Sulpicius Gallus* is much larger than the little crater which forms the centre of the spot. It cannot be doubted that a change has taken place, and it seems probable that an eruption has filled the ancient crater with a material white enough to look bright against the dark ground of the sea."

Neither is this description very distinct; but, on the whole, it would seem that the black spot, which Schmidt considers a hill, appears to Secchi as a crater, and Secchi's "small prominent point with a shadow," may possibly be the fine white summit west of the black point noticed by Schmidt.

Without further observations, it would be premature to speculate with any confidence on the probable conditions of the eruption. It would appear, according to Secchi's view, that the outbreak has already ceased, after filling up the greater part of the old crater, and leaving quite an inconsiderable one in its place, so that there is now, in fact, no obscuration in the proper sense of the term. If, on the other hand, there is no sign of any crater whatever, the eruption may still be going on, and the crater may be filled with an over-boiling mass of bright matter which is flowing away from it on all sides; or it may be really obscured by a vapour. Schmidt does not think that there is a vapour, as appears in a letter translated from the *Cologne Gazette* for the *Intellectual Observer* (April, 1867) by Mr. Lynn. Schmidt says:—"An eruption of vapour or ashes is not probable, because a shadow of that which covered the crater would be thrown at sunrise and sunset; but this is never the case. Had the crater sunk below, in its place a great shadow would be visible during the phase. Had the ring-mountain been destroyed, the fragments would throw shadows; which also is not the case. Had the crater been filled up by an eruption of fluid or powdery matter without overflowing, the interior black shadow at sunrise and sunset would indeed disappear, but there would remain a hill throwing a shadow on the outside. This was the appearance seen by Schroter in 1790 in the central part of Posidonius, and by Julius Schmidt in the same object in February, 1849. But such a mass of matter may also have flowed out over the outside banks, and covered the surrounding declivity with a very gradually sloping inclination. This would prevent the casting of a shadow outside at the phase. Such an event would explain

all the phenomena presented by Linné, and it is the kind of event which, in the mud volcano in the peninsula of Tannan, so closely described by Abich, has so striking an analogue on our earth. The spreading of the overflowing bright mass over the dark plain gives occasion to the origin of broad formations similar to a halo, which are seen frequently upon the moon, especially in the so-called *Mare*."

But there seems to be no reason why a condensing vapour should not assume the same shadowless slope, and, considering that the ejected matter may have appeared in a vaporous, a fluid, or a solid state, or in different states, it is evident that great caution should be used, for the present, at least, in offering any decided opinion as to its condition. It may be noticed as a striking fact, that the obscuration in Schroter's time passed away; and it might be expected that the present would also come to an end without any permanent filling up of the crater. However, the two "obscurations" seem very different in character, as the first was a darkening, while brightness and absence of shadow distinguish the recent phenomenon; and the final effects of both may be very different also.

If the body that obscures the old form of Linné is really a vapour, it would afford an independent proof of the airless condition of the moon in showing the absence of winds over her surface. If winds were there, it should certainly display their action, and could not persistently maintain its circular shape. But its outline has remained unchanged. The white cloud, if cloud it is, betrays no yielding to any superficial force, and its solemn pall hangs motionless over the awful vault.

But here still would be only a confirmation of what is otherwise established; and it may not be inapt to notice one of its peculiar effects in connection with the eruption of Linné, supposing the moon to be inhabited by sentient beings. If, then, our satellite contains a form of life suitable to the conditions that obtain there—and we cannot know whether it does or not—it is plain that, unless, indeed, the vibrations of the ground serve with adapted organs for the purpose of hearing, the eruption of Linné, however great it may be, and frightful to the sight, can yield no sound. The whole land may heave with a force unknown in our most dreadful earthquakes; a hundred chasms may yawn wide and breathe forth their breath of flame; the lofty peak may cleave asunder before the issuing lightning; the sun may darken behind the volleyed rocks, or the lofty shroud of vapour; and the encircling cliff for miles may fall down in the uttermost confusion—still there are no smothered rumblings in the deep abyss—no thunder among the hills—no roaring in the red throat of the fire mountain; for even Ruin, wielding her greatest terrors, can have no voice in the airless space; and were all the volcanoes of the moon in eruption together they would be as noiseless, to human ears, as the cushioned feet of a butterfly lighting on a flower.

I will not here discuss how an atmosphere of some kind might be expected to result from the discharges of gas from volcanoes, if from no other source. A perfectly transparent, and, at the same time, sound-transmitting air-covering might exist if only the absence of oxygen or hydrogen forbid the formation of water and its consequent phenomena of evaporation, rain and mist. However, the moon affords no proof of an envelope even such as this; and any subject relating to her is rightly treated under the assumption that she possesses none.

Now, proceeding with the supposition that the ejected matter which is visible to us might, possibly, be the vapour of minerals in that powdery state which seems transitional between a fluid and a gas, it may be interesting to consider how a vapour would behave at the surface of the moon.

For this it will be sufficient to recollect that the rising of a light body is, properly speaking, caused by the weight of that in which it is immersed, where the heavier particles tend to gravitate into its place, and push it upwards. It is plain, therefore, that this vapour could not rise on account of its lightness where there is no upheaving medium; and its total elevation would, consequently, be due to gaseous elasticity and impulsive force. Even if there was an atmosphere of greater specific gravity than the highly heated vapour, still the latter, after its ejection, should begin so quickly to lower in temperature that its expansion to any considerable extent would be impossible; and the result, in any case, would be, probably, what might be called a rain of recondensing minerals.

In point of fact the white cloud might be a condensing vapour; or it might be a solid or fluid outpour; or it might be the resulting formation of matter ejected in any shape. But, be this as it may, it seems established on a high authority—and this is the point of paramount importance—that the moon betrays the continued existence of those forces which, in the operations of countless ages, have impressed her surface with a character so strange, so void, and so forlorn, that if such scenes were discovered in some hitherto unexplored region of the earth, they would freeze with awe the blood of the beholder.

It may be regretted that the phenomenon did not occur in a crater more remarkable and generally known than Linné, for there is, probably, not a person living, besides Schmidt himself, whose acquaintance with the place, derived from his own observations of twenty-five years, would enable him to pronounce decidedly on a change in its appearance. An alteration of feature in any one of a number of other craters might be proved by a host of witnesses; but at the same time it must be remembered that the distinguished observer who presides over the Athens observatory, is, indeed, equal to a host in himself.

Having referred to Linné as bearing testimony to the absence of a lunar atmosphere, which, again, I believe to be a strong evidence of creative design, I think it not out of place to state that, on the other hand, our satellite was considered by an eminent philosopher as affording a proof that the world was not formed by an omnipotent intelligence. Laplace says that the moon is not situated to the best advantage for giving light, as she does not always shine in the absence of the sun. To attain the object for which the partisans of final causes imagine her to be intended, it would have been sufficient at the beginning to place her in opposition to the sun in the plane of the ecliptic, and at a hundredth part of the distance of the sun from the earth, at the same time giving her a motion by which the opposition would ever be maintained. The distance would secure her against eclipse, and there would thus be a continual full moon rising regularly at sunset.

But it may be proved mathematically that the moon could not retain that position with respect to the earth; and, even if she could, the au-