

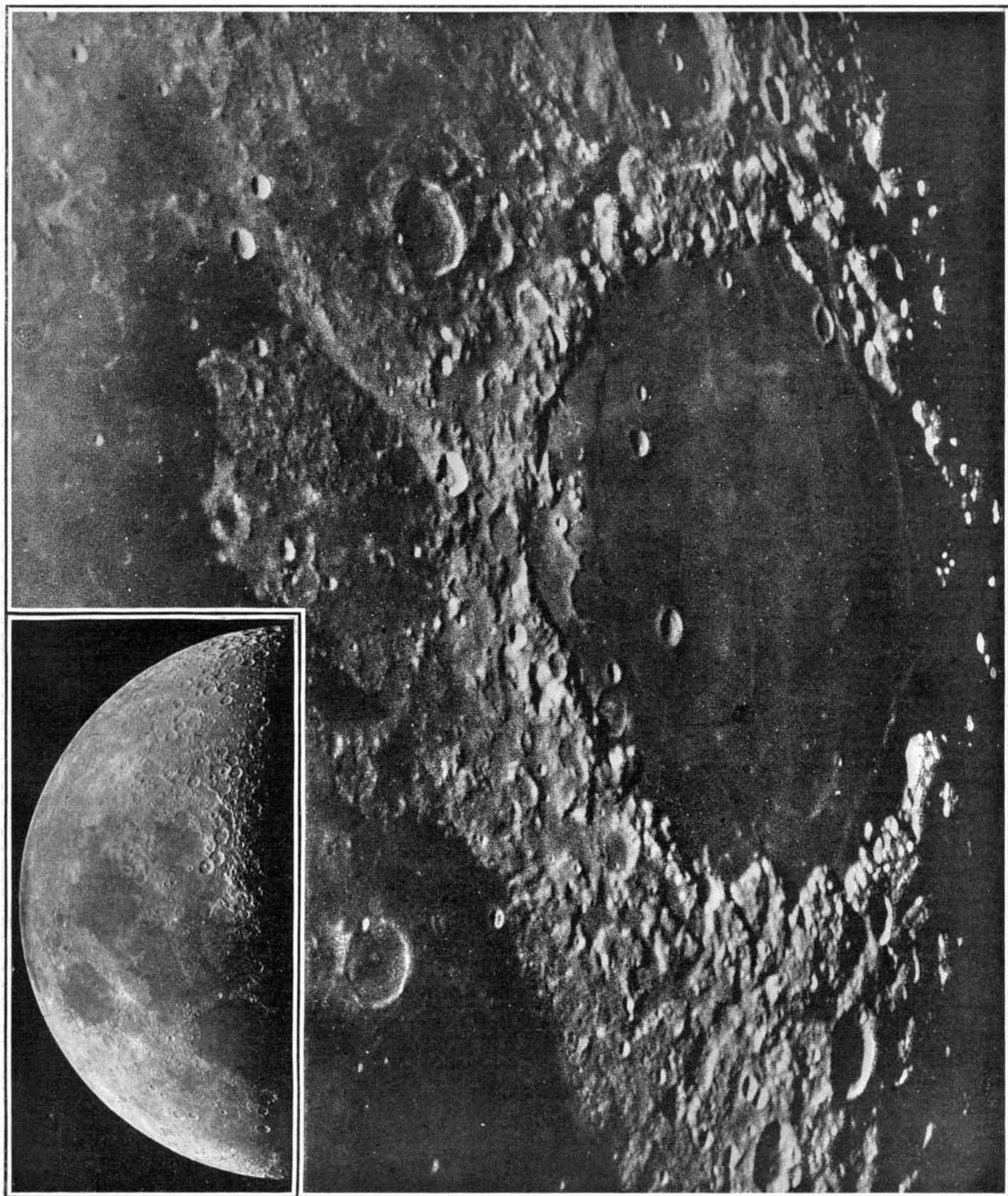
SCIENTIFIC AMERICAN

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Vol. XCIII.—No. 26.
ESTABLISHED 1843.

NEW YORK, DECEMBER 23, 1905.

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\$3.00 A YEAR.]



TWO PHOTOGRAPHS OF THE MOON TAKEN BY LOEWY AND PUISEUX WITH THE EQUATORIAL COUDÉ OF THE PARIS OBSERVATORY.—[See page 511.]

IS THERE LIFE ON THE MOON?

There was a time in the history of the earth when it had no satellite, when it was not the globe we know it now, but a great liquid planet incrustated by a shell some thirty-five miles in thickness. That time is separated from us by an interval which cannot be accurately determined, but which must be measured by millions of years at least. In those early days of its planetary career, the earth spun on its axis with a constantly-increasing swiftness that reduced the day to a few hours. When the period of revolution had finally dwindled to a bare three hours, a catastrophe occurred, one of the most fearful in all celestial history. Such was the enormity of the centrifugal force of the earth, that five thousand million cubic miles of its mass were hurled off into space. In that cataclysm our moon was born.

Strange as its origin may be, the moon has still other peculiarities to offer. It is the largest of all planetary satellites, so large indeed that to the inhabitants of a neighboring world it must appear with the earth as a marvelously beautiful double planet.

Because it is smaller in mass than the earth, the attraction of gravitation on the moon is considerably less than it is on the earth. If it were possible for one of us to journey to the moon and live there, we should find ourselves able to accomplish six times as much as we can on the earth. We could lift weights six times as heavy, run six times as fast, work six times as hard—all because the moon attracts bodies with but one-sixth the force of the earth. We could leap over barns with ease, and run a mile at express-train speed.

Despite the chasm of 253,000 miles that separates us from the moon, we know more of the physical characteristics of the single pallid face which it ever turns toward us than we do of the Arctic regions, or of the heart of Africa. We have studied, mapped, and photographed the great dark plains which were once thought to be seas and were accordingly mis-called "maria;" the lofty mountain ranges that sometimes tower 20,000 feet above the seas; and the vast, annular craters that pit the moon's aged features.

Although it once formed part of the earth, the moon is different from our globe in many respects. Charred by fires long since dead, honeycombed like a giant ball of slag, scarred by terrific volcanic upheavals, its telescopic aspect is anything but cheerful. Craters are not uncommon features of the earth; but on the moon their number and size are truly astonishing. At the lunar south pole these dead volcanoes are so closely packed together that to Galileo (the first man who ever saw the moon through a telescope) they seemed like the eyes of a peacock's tail. So large, indeed, are many of these craters, that a man standing within one of them would be unable to see the surrounding ramparts, because they would lie below his horizon. A diameter of ten, twenty, or even sixty miles is not infrequently met with in a lunar crater.

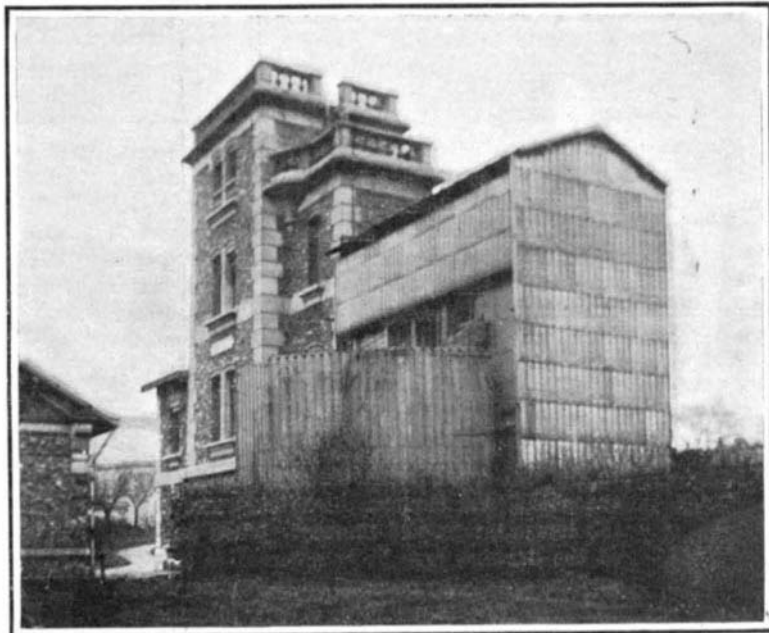
Are these craters all dead? Most astronomers believe so, but Prof. W. H. Pickering, of Harvard University, has recorded a number of observa-

tions that seem to point to the activity of a few of them at least. He relies chiefly on the fluctuations in size which have been observed in a comparatively small crater called Linné. On an old map one observer records Linné as a crater of moderate size. A century later it is described as a small, round, brilliant spot. When modern instruments of precision were invented the crater was measured repeatedly, with decidedly surprising results. Once its diameter was four miles; then it grew to six miles; and now it has shrunk to three-quarters of a mile. If this volcano is extinct, how comes it that it changes its size so strangely? Still another proof of activity is found by Prof. Pickering in the eccentricities of a gigantic crater called Plato, and in dense clouds of white vapor which have

appeared before his eyes, rising from a tortuous cleft known as Schroeter's Valley. So minute have been Prof. Pickering's observations that their accuracy can not be seriously called into question.

Granting that a few of the moon's craters are active, it follows that they must discharge something into space. That something, judged by our earthly volcanoes, must be water and carbonic acid gas. Because the pressure on the moon's surface is exceedingly low, and because the temperature during the long, cold lunar night is probably not far from 460 deg. F. below zero, water cannot possibly exist in the fluid state. Ice and snow are the only forms water can assume.

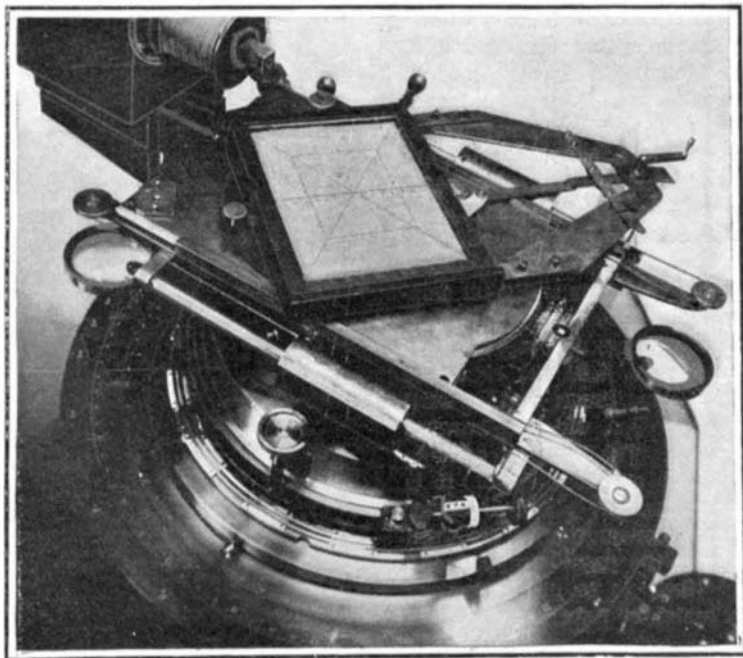
Is there any evidence of snow and ice? Almost every crater is lined with white. The lofty peaks of



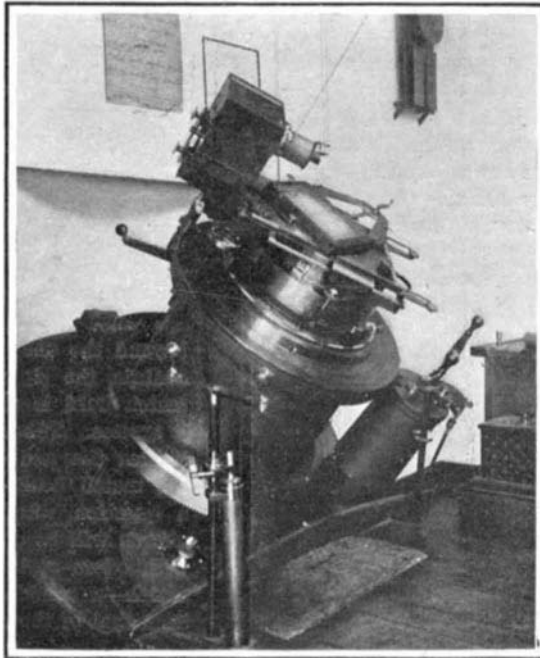
THE BUILDING IN WHICH THE EQUATORIAL COUDÉ IS HOUSED.

mountain ranges are hooded in white. At the South Pole the white glare is almost blinding. What is this white sheen? Merely the natural color of the moon's wrinkled face, according to most astronomers—snow and ice, forming where it should form, according to Prof. Pickering. The disappearance and reappearance of these white spots are admirably explained by this theory; for snow and ice would vaporize in the long lunar day—equal to fifteen of our days, and congeal again in white crystals as the sun set.

It has been said that an earthly volcano vomits carbonic acid. Conceding that a lunar crater ejects water in the form of a vapor and carbonic acid gas, is there any reason why life, in its lowest forms at least, may not exist on the moon? Prof. Pickering be-



PHOTOGRAPHIC MOUNTING OF THE EQUATORIAL.



A GLIMPSE OF THE GREAT TELESCOPE.

lieves that he has discovered traces of vegetation. There are variable spots on the moon, spots that darken after sunrise and gradually disappear toward sunset. They are not shadows, for they are most pronounced when the sun is high in the heavens. They appear quickly at the equator, and encroach on the higher latitudes after a few days have elapsed. They are never seen in the polar regions. It is in these variable spots that Prof. Pickering has discovered what he considers to be vegetation. Whether he is right or wrong, this much is certain: He has explained with admirable simplicity a phenomenon that has long puzzled astronomers. To offset the objections that the temperature of the moon is too low to support organic life, it may be answered that certain

lichens thrive in our own Arctic regions, where the temperature rarely rises above the melting point of ice. Moreover, many bacteria resist the most intense cold that we can produce. It may be objected that in a single day vegetation cannot grow appreciably; but on the moon a day is equal to fifteen of our days, and may well be likened to a miniature season.

The advances which have recently been made in selenography by Prof. Pickering show that although the moon is not a riotously luxuriant abode, it is anything but the lifeless orb commonly supposed. It may be desolate and cold; but it is not altogether dead.

Effluviography.

The following translation of a communication on effluviology, or obtaining the photographic image by the electric effluvium (silent discharge), presented by the scientist Tomassi to the Académie des Sciences on March 22, 1886, ten years before the publication of Roentgen's memoir on the X-rays, may be read with interest by those who have not been familiar with the earlier researches:

I have the honor to submit to the judgment of the academy the first results of my researches on the method of obtaining by the sole action of the electric effluvium the effects realized by the employment of light in photography.

To photograph objects without the concurrence of light, or more exactly to effluviograph them, I have employed the following arrangement: Two metallic brushes, arranged parallel to each other, are connected with the battery of a Holtz machine. A gelatino-bromide plate of about the same height is placed perpendicularly to the brushes in such a way that the plane of the sensitive face embraces the borders of these brushes, or is very near them in both directions. When the current is established, a pose of a few minutes is sufficient. I have no need to record the fact that this operation should be conducted in complete darkness. There is then nothing further to do than to develop the image obtained and fix it by means of the ordinary processes. This experiment tends to prove that the effluvium produces the same effects as the ultra-violet rays, that consequently there must be a bond between the two extreme parts of the spectrum, and that this bond consists of what I will call provisionally, "electric rays."

To assure myself that the electric discharge contains other rays than the actinic rays, I have made the following experiment. I placed on a gelatino-bromide plate a piece of paper impressed as a negative. Then I put the whole in a frame. It was enveloped in such a way that, after a certain exposure to the

light, no alteration was produced. I was then certain that the envelope was completely opaque; that is, that the protection against luminous rays was absolute.

Above the frames thus enveloped, I produced a series of silent electric discharges, of which the light could not influence the sensitive plate more than daylight. Yet an action was produced, and the image obtained, developed, and fixed was identical with that which the action

of luminous rays would have given. It must therefore be concluded that electric light contains, besides the actinic rays, that particular class of rays which I have denominated "electric rays," and of which I have demonstrated the existence by making use of obscure discharges; that is to say, void of luminous rays.

Under the ordinary conditions of service, priming is produced by suspended matter in the boiler, and without regard to the amount of alkaline salts. The loss of water and heat through priming creates much danger in the boiler from the uncertainty of the height of the water and detracts from the power and efficiency of the locomotive.