CHAPTER XIII.

LUNAR LANDSCAPES

At half past two in the morning of December 6th, the travellers crossed the 30th northern parallel, at a distance from the lunar surface of 625 miles, reduced to about 6 by their spy-glasses. Barbican could not yet see the least probability of their landing at any point of the disc. The velocity of the Projectile was decidedly slow, but for that reason extremely puzzling. Barbican could not account for it. At such a proximity to the Moon, the velocity, one would think, should be very great indeed to be able to counteract the lunar attraction. Why did it not fall? Barbican could not tell; his companions were equally in the dark. Ardan said he gave it up. Besides they had no time to spend in investigating it. The lunar panorama was unrolling all its splendors beneath them, and they could not bear to lose one of its slightest details.

The lunar disc being brought within a distance of about six miles by the spy-glasses, it is a fair question to ask, what could an aeronaut at such an elevation from our Earth discover on its surface? At present that question can hardly be answered, the most remarkable balloon ascensions never having passed an altitude of five miles under circumstances favorable for observers. Here, however, is an account, carefully transcribed from notes taken on the spot, of what Barbican and his companions did see from their peculiar post of observation.

Varieties of color, in the first place, appeared here and there upon the disc. Selenographers are not quite agreed as to the nature of these colors. Not that such colors are without variety or too faint to be easily distinguished. Schmidt of Athens even says that if our oceans on earth were all evaporated, an observer in the Moon would hardly find the seas and continents of our globe even so well outlined as those of the Moon are to the eye of a terrestrial observer. According to him, the shade of color distinguishing those vast plains known as "seas" is a dark gray dashed with green and brown,--a color presented also by a few of the great craters.

This opinion of Schmidt's, shared by Beer and Maedler, Barbican's observations now convinced him to be far better founded than that of certain astronomers who admit of no color at all being visible on the Moon's surface but gray. In certain spots the greenish tint was quite decided, particularly in Mare Serenitatis and Mare Humorum, the very localities where Schmidt had most noticed it. Barbican also remarked that several large craters, of the class that had no interior cones, reflected a kind of bluish tinge, somewhat like that given forth by a freshly polished steel plate. These tints, he now saw enough to convince him, proceeded really from the lunar surface, and were not due, as certain astronomers asserted, either to the imperfections of the spy-glasses, or to the interference of the terrestrial atmosphere. His singular opportunity for correct observation allowed him to entertain no doubt whatever on the subject. Hampered by no atmosphere, he was free from all liability to optical illusion. Satisfied therefore as to the

reality of these tints, he considered such knowledge a positive gain to science. But that greenish tint--to what was it due? To a dense tropical vegetation maintained by a low atmosphere, a mile or so in thickness? Possibly. But this was another question that could not be answered at present.

Further on he could detect here and there traces of a decidedly ruddy tint. Such a shade he knew had been already detected in the Palus Somnii, near Mare Crisium, and in the circular area of Lichtenberg, near the Hercynian Mountains, on the eastern edge of the Moon. To what cause was this tint to be attributed? To the actual color of the surface itself? Or to that of the lava covering it here and there? Or to the color resulting from the mixture of other colors seen at a distance too great to allow of their being distinguished separately? Impossible to tell.

Barbican and his companions succeeded no better at a new problem that soon engaged their undivided attention. It deserves some detail.

Having passed Lambert, being just over Timocharis, all were attentively gazing at the magnificent crater of Archimedes with a diameter of 52 miles across and ramparts more than 5000 feet in height, when Ardan startled his companions by suddenly exclaiming:

"Hello! Cultivated fields as I am a living man!"

"What do you mean by your cultivated fields?" asked M'Nicholl sourly,

wiping his glasses and shrugging his shoulders.

"Certainly cultivated fields!" replied Ardan. "Don't you see the furrows? They're certainly plain enough. They are white too from glistening in the sun, but they are quite different from the radiating streaks of Copernicus. Why, their sides are perfectly parallel!"

"Where are those furrows?" asked M'Nicholl, putting his glasses to his eye and adjusting the focus.

"You can see them in all directions," answered Ardan; "but two are particularly visible: one running north from Archimedes, the other south towards the Apennines."

M'Nicholl's face, as he gazed, gradually assumed a grin which soon developed into a snicker, if not a positive laugh, as he observed to Ardan:

"Your Selenites must be Brobdignagians, their oxen Leviathans, and their ploughs bigger than Marston's famous cannon, if these are furrows!"

"How's that, Barbican?" asked Ardan doubtfully, but unwilling to submit to M'Nicholl.

"They're not furrows, dear friend," said Barbican, "and can't be, either, simply on account of their immense size. They are what the German astronomers called Rillen; the French, rainures, and the

English, grooves, canals, clefts, cracks, chasms, or fissures."

"You have a good stock of names for them anyhow," observed Ardan, "if that does any good."

"The number of names given them," answered Barbican, "shows how little is really known about them. They have been observed in all the level portion of the Moon's surface. Small as they appear to us, a little calculation must convince you that they are in some places hundreds of miles in length, a mile in width and probably in many points several miles in depth. Their width and depth, however, vary, though their sides, so far as observed, are always rigorously parallel. Let us take a good look at them."

Putting the glass to his eye, Barbican examined the clefts for some time with close attention. He saw that their banks were sharp edged and extremely steep. In many places they were of such geometrical regularity that he readily excused Gruithuysen's idea of deeming them to be gigantic earthworks thrown up by the Selenite engineers. Some of them were as straight as if laid out with a line, others were curved a little here and there, though still maintaining the strict parallelism of their sides. These crossed each other; those entered craters and came out at the other side. Here, they furrowed annular plateaus, such as Posidonius or Petavius. There, they wrinkled whole seas, for instance, Mare Serenitatis.

These curious peculiarities of the lunar surface had interested the astronomic mind to a very high degree at their first discovery, and have proved to be very perplexing problems ever since. The first observers do not seem to have noticed them. Neither Hevelius, nor Cassini, nor La Hire, nor Herschel, makes a single remark regarding their nature.

It was Schroeter, in 1789, who called the attention of scientists to them for the first time. He had only 11 to show, but Lohrmann soon recorded 75 more. Pastorff, Gruithuysen, and particularly Beer and Maedler were still more successful, but Julius Schmidt, the famous astronomer of Athens, has raised their number up to 425, and has even published their names in a catalogue. But counting them is one thing, determining their nature is another. They are not fortifications, certainly: and cannot be ancient beds of dried up rivers, for two very good and sufficient reasons: first, water, even under the most favorable circumstances on the Moon's surface, could have never ploughed up such vast channels; secondly, these chasms often traverse lofty craters through and through, like an immense railroad cutting.

At these details, Ardan's imagination became unusually excited and of course it was not without some result. It even happened that he hit on an idea that had already suggested itself to Schmidt of Athens.

"Why not consider them," he asked, "to be the simple phenomena of vegetation?"

"What do you mean?" asked Barbican.

"Rows of sugar cane?" suggested M'Nicholl with a snicker.

"Not exactly, my worthy Captain," answered Ardan quietly, "though you were perhaps nearer to the mark than you expected. I don't mean exactly rows of sugar cane, but I do mean vast avenues of trees--poplars, for instance--planted regularly on each side of a great high road."

"Still harping on vegetation!" said the Captain. "Ardan, what a splendid historian was spoiled in you! The less you know about your facts, the readier you are to account for them."

"Ma foi," said Ardan simply, "I do only what the greatest of your scientific men do--that is, guess. There is this difference however between us--I call my guesses, guesses, mere conjecture;--they dignify theirs as profound theories or as astounding discoveries!"

"Often the case, friend Ardan, too often the case," said Barbican.

"In the question under consideration, however," continued the Frenchman, "my conjecture has this advantage over some others: it explains why these rills appear and seem to disappear at regular intervals."

"Let us hear the explanation," said the Captain.

"They become invisible when the trees lose their leaves, and they reappear when they resume them."

"His explanation is not without ingenuity," observed Barbican to M'Nicholl, "but, my dear friend," turning to Ardan, "it is hardly admissible."

"Probably not," said Ardan, "but why not?"

"Because as the Sun is nearly always vertical to the lunar equator, the Moon can have no change of seasons worth mentioning; therefore her vegetation can present none of the phenomena that you speak of."

This was perfectly true. The slight obliquity of the Moon's axis, only 1-1/2°, keeps the Sun in the same altitude the whole year around. In the equatorial regions he is always vertical, and in the polar he is never higher than the horizon. Therefore, there can be no change of seasons; according to the latitude, it is a perpetual winter, spring, summer, or autumn the whole year round. This state of things is almost precisely similar to that which prevails in Jupiter, who also stands nearly upright in his orbit, the inclination of his axis being only about 3°.

But how to account for the grooves? A very hard nut to crack. They must certainly be a later formation than the craters and the rings, for they are often found breaking right through the circular ramparts. Probably the latest of all lunar features, the results of the last geological epochs, they are due altogether to expansion or shrinkage acting on a large scale and brought about by the great forces of nature, operating after a manner altogether unknown on our earth. Such at least

was Barbican's idea.

"My friends," he quietly observed, "without meaning to put forward any pretentious claims to originality, but by simply turning to account some advantages that have never before befallen contemplative mortal eye, why not construct a little hypothesis of our own regarding the nature of these grooves and the causes that gave them birth? Look at that great chasm just below us, somewhat to the right. It is at least fifty or sixty miles long and runs along the base of the Apennines in a line almost perfectly straight. Does not its parallelism with the mountain chain suggest a causative relation? See that other mighty rill, at least a hundred and fifty miles long, starting directly north of it and pursuing so true a course that it cleaves Archimedes almost cleanly into two. The nearer it lies to the mountain, as you perceive, the greater its width; as it recedes in either direction it grows narrower. Does not everything point out to one great cause of their origin? They are simple crevasses, like those so often noticed on Alpine glaciers, only that these tremendous cracks in the surface are produced by the shrinkage of the crust consequent on cooling. Can we point out some analogies to this on the Earth? Certainly. The defile of the Jordan, terminating in the awful depression of the Dead Sea, no doubt occurs to you on the moment. But the Yosemite Valley, as I saw it ten years ago, is an apter comparison. There I stood on the brink of a tremendous chasm with perpendicular walls, a mile in width, a mile in depth and eight miles in length. Judge if I was astounded! But how should we feel it, when travelling on the lunar surface, we should suddenly find ourselves on the brink of a yawning chasm two miles wide, fifty miles long, and so

fathomless in sheer vertical depth as to leave its black profundities absolutely invisible in spite of the dazzling sunlight!"

"I feel my flesh already crawling even in the anticipation!" cried Ardan.

"I shan't regret it much if we never get to the Moon," growled M'Nicholl; "I never hankered after it anyhow!"

By this time the Projectile had reached the fortieth degree of lunar latitude, and could hardly be further than five hundred miles from the surface, a distance reduced to about 5 miles by the travellers' glasses. Away to their left appeared Helicon, a ring mountain about 1600 feet high; and still further to the left the eye could catch a glimpse of the cliffs enclosing a semi-elliptical portion of Mare Imbrium, called the Sinus Iridium, or Bay of the Rainbows.

In order to allow astronomers to make complete observations on the lunar surface, the terrestrial atmosphere should possess a transparency seventy times greater than its present power of transmission. But in the void through which the Projectile was now floating, no fluid whatever interposed between the eye of the observer and the object observed. Besides, the travellers now found themselves at a distance that had never before been reached by the most powerful telescopes, including even Lord Rosse's and the great instrument on the Rocky Mountains. Barbican was therefore in a condition singularly favorable to resolve the great question concerning the Moon's inhabitableness. Nevertheless,

the solution still escaped him. He could discover nothing around him but a dreary waste of immense plains, and towards the north, beneath him, bare mountains of the aridest character.

Not the slightest vestige of man's work could be detected over the vast expanse. Not the slightest sign of a ruin spoke of his ever having been there. Nothing betrayed the slightest trace of the development of animal life, even in an inferior degree. No movement. Not the least glimpse of vegetation. Of the three great kingdoms that hold dominion on the surface of the globe, the mineral, the vegetable and the animal, one alone was represented on the lunar sphere: the mineral, the whole mineral, and nothing but the mineral.

"Why!" exclaimed Ardan, with a disconcerted look, after a long and searching examination, "I can't find anybody. Everything is as motionless as a street in Pompeii at 4 o'clock in the morning!"

"Good comparison, friend Ardan;" observed M'Nicholl. "Lava, slag, volcanic eminences, vitreous matter glistening like ice, piles of scoria, pitch black shadows, dazzling streaks, like rivers of light breaking over jagged rocks--these are now beneath my eye--these alone I can detect--not a man--not an animal--not a tree. The great American Desert is a land of milk and honey in comparison with the joyless orb over which we are now moving. However, even yet we can predicate nothing positive. The atmosphere may have taken refuge in the depths of the chasms, in the interior of the craters, or even on the opposite side of the Moon, for all we know!"

"Still we must remember," observed Barbican, "that even the sharpest eye cannot detect a man at a distance greater than four miles and a-half, and our glasses have not yet brought us nearer than five."

"Which means to say," observed Ardan, "that though we can't see the Selenites, they can see our Projectile!"

But matters had not improved much when, towards four o'clock in the morning, the travellers found themselves on the 50th parallel, and at a distance of only about 375 miles from the lunar surface. Still no trace of the least movement, or even of the lowest form of life.

"What peaked mountain is that which we have just passed on our right?" asked Ardan. "It is quite remarkable, standing as it does in almost solitary grandeur in the barren plain."

"That is Pico," answered Barbican. "It is at least 8000 feet high and is well known to terrestrial astronomers as well by its peculiar shadow as on account of its comparative isolation. See the collection of perfectly formed little craters nestling around its base."

"Barbican," asked M'Nicholl suddenly, "what peak is that which lies almost directly south of Pico? I see it plainly, but I can't find it on my map."

"I have remarked that pyramidal peak myself," replied Barbican; "but I

can assure you that so far it has received no name as yet, although it is likely enough to have been distinguished by the terrestrial astronomers. It can't be less than 4000 feet in height."

"I propose we called it Barbican!" cried Ardan enthusiastically.

"Agreed!" answered M'Nicholl, "unless we can find a higher one."

"We must be before-hand with Schmidt of Athens!" exclaimed Ardan. "He will leave nothing unnamed that his telescope can catch a glimpse of."

"Passed unanimously!" cried M'Nicholl.

"And officially recorded!" added the Frenchman, making the proper entry on his map.

"Salve, Mt. Barbican!" then cried both gentlemen, rising and taking off their hats respectfully to the distant peak.

"Look to the west!" interrupted Barbican, watching, as usual, while his companions were talking, and probably perfectly unconscious of what they were saying; "directly to the west! Now tell me what you see!"

"I see a vast valley!" answered M'Nicholl.

"Straight as an arrow!" added Ardan.

"Running through lofty mountains!" cried M'Nicholl.

"Cut through with a pair of saws and scooped out with a chisel!" cried Ardan.

"See the shadows of those peaks!" cried M'Nicholl catching fire at the sight. "Black, long, and sharp as if cast by cathedral spires!"

"Oh! ye crags and peaks!" burst forth Ardan; "how I should like to catch even a faint echo of the chorus you could chant, if a wild storm roared over your beetling summits! The pine forests of Norwegian mountains howling in midwinter would not be an accordeon in comparison!"

"Wonderful instance of subsidence on a grand scale!" exclaimed the Captain, hastily relapsing into science.

"Not at all!" cried the Frenchman, still true to his colors; "no subsidence there! A comet simply came too close and left its mark as it flew past."

"Fanciful exclamations, dear friends," observed Barbican; "but I'm not surprised at your excitement. Yonder is the famous Valley of the Alps, a standing enigma to all selenographers. How it could have been formed, no one can tell. Even wilder guesses than yours, Ardan, have been hazarded on the subject. All we can state positively at present regarding this wonderful formation, is what I have just recorded in my note-book: the Valley of the Alps is about 5 mile wide and 70 or 80

long: it is remarkably flat and free from debris, though the mountains on each side rise like walls to the height of at least 10,000 feet.--Over the whole surface of our Earth I know of no natural phenomenon that can be at all compared with it."

"Another wonder almost in front of us!" cried Ardan. "I see a vast lake black as pitch and round as a crater; it is surrounded by such lofty mountains that their shadows reach clear across, rendering the interior quite invisible!"

"That's Plato;" said M'Nicholl; "I know it well; it's the darkest spot on the Moon: many a night I gazed at it from my little observatory in Broad Street, Philadelphia."

"Right, Captain," said Barbican; "the crater Plato, is, indeed, generally considered the blackest spot on the Moon, but I am inclined to consider the spots Grimaldi and Riccioli on the extreme eastern edge to be somewhat darker. If you take my glass, Ardan, which is of somewhat greater power than yours, you will distinctly see the bottom of the crater. The reflective power of its plateau probably proceeds from the exceedingly great number of small craters that you can detect there."

"I think I see something like them now," said Ardan. "But I am sorry the Projectile's course will not give us a vertical view."

"Can't be helped!" said Barbican; "we must go where it takes us. The day may come when man can steer the projectile or the balloon in which he is

shut up, in any way he pleases, but that day has not come yet!"

Towards five in the morning, the northern limit of Mare Imbrium was finally passed, and Mare Frigoris spread its frost-colored plains far to the right and left. On the east the travellers could easily see the ring-mountain Condamine, about 4000 feet high, while a little ahead on the right they could plainly distinguish Fontenelle with an altitude nearly twice as great. Mare Frigoris was soon passed, and the whole lunar surface beneath the travellers, as far as they could see in all directions, now bristled with mountains, crags, and peaks. Indeed, at the 70th parallel the "Seas" or plains seem to have come to an end. The spy-glasses now brought the surface to within about three miles, a distance less than that between the hotel at Chamouni and the summit of Mont Blanc. To the left, they had no difficulty in distinguishing the ramparts of Philolaus, about 12,000 feet high, but though the crater had a diameter of nearly thirty miles, the black shadows prevented the slightest sign of its interior from being seen. The Sun was now sinking very low, and the illuminated surface of the Moon was reduced to a narrow rim.

By this time, too, the bird's eye view to which the observations had so far principally confined, decidedly altered its character. They could now look back at the lunar mountains that they had been just sailing over--a view somewhat like that enjoyed by a tourist standing on the summit of Mt. St. Gothard as he sees the sun setting behind the peaks of the Bernese Oberland. The lunar landscapes however, though seen under these new and ever varying conditions, "hardly gained much by the

change," according to Ardan's expression. On the contrary, they looked, if possible, more dreary and inhospitable than before.

The Moon having no atmosphere, the benefit of this gaseous envelope in softening off and nicely shading the approaches of light and darkness, heat and cold, is never felt on her surface. There, no twilight ever softly ushers in the brilliant sun, or sweetly heralds the near approach of night's dark shadow. Night follows day, and day night, with the startling suddenness of a match struck or a lamp extinguished in a cavern. Nor can it present any gradual transition from either extreme of temperature. Hot jumps to cold, and cold jumps to hot. A moment after a glacial midnight, it is a roasting noon. Without an instant's warning the temperature falls from 212° Fahrenheit to the icy winter of interstellar space. The surface is all dazzling glare, or pitchy gloom. Wherever the direct rays of the sun do not fall, darkness reigns supreme. What we call diffused light on Earth, the grateful result of refraction, the luminous matter held in suspension by the air, the mother of our dawns and our dusks, of our blushing mornings and our dewy eyes, of our shades, our penumbras, our tints and all the other magical effects of chiaro-oscuro--this diffused light has absolutely no existence on the surface of the Moon. Nothing is there to break the inexorable contrast between intense white and intense black. At mid-day, let a Selenite shade his eyes and look at the sky: it will appear to him as black as pitch, while the stars still sparkle before him as vividly as they do to us on the coldest and darkest night in winter.

From this you can judge of the impression made on our travellers by

those strange lunar landscapes. Even their decided novelty and very strange character produced any thing but a pleasing effect on the organs of sight. With all their enthusiasm, the travellers felt their eyes "get out of gear," as Ardan said, like those of a man blind from his birth and suddenly restored to sight. They could not adjust them so as to be able to realize the different plains of vision. All things seemed in a heap. Foreground and background were indistinguishably commingled. No painter could ever transfer a lunar landscape to his canvas.

"Landscape," Ardan said; "what do you mean by a landscape? Can you call a bottle of ink intensely black, spilled over a sheet of paper intensely white, a landscape?"

At the eightieth degree, when the Projectile was hardly 100 miles distant from the Moon, the aspect of things underwent no improvement. On the contrary, the nearer the travellers approached the lunar surface, the drearier, the more inhospitable, and the more unearthly, everything seem to look. Still when five o'clock in the morning brought our travellers to within 50 miles of Mount Gioja--which their spy-glasses rendered as visible as if it was only about half a mile off, Ardan could not control himself.

"Why, we're there" he exclaimed; "we can touch her with our hands! Open the windows and let me out! Don't mind letting me go by myself. It is not very inviting quarters I admit. But as we are come to the jumping off place, I want to see the whole thing through. Open the lower window and let me out. I can take care of myself!"

"That's what's more than any other man can do," said M'Nicholl drily, "who wants to take a jump of 50 miles!"

"Better not try it, friend Ardan," said Barbican grimly: "think of Satellite! The Moon is no more attainable by your body than by our Projectile. You are far more comfortable in here than when floating about in empty space like a bolide."

Ardan, unwilling to quarrel with his companions, appeared to give in; but he secretly consoled himself by a hope which he had been entertaining for some time, and which now looked like assuming the appearance of a certainty. The Projectile had been lately approaching the Moon's surface so rapidly that it at last seemed actually impossible not to finally touch it somewhere in the neighborhood of the north pole, whose dazzling ridges now presented themselves in sharp and strong relief against the black sky. Therefore he kept silent, but quietly bided his time.

The Projectile moved on, evidently getting nearer and nearer to the lunar surface. The Moon now appeared to the travellers as she does to us towards the beginning of her Second Quarter, that is as a bright crescent instead of a hemisphere. On one side, glaring dazzling light; on the other, cavernous pitchy darkness. The line separating both was broken into a thousand bits of protuberances and concavities, dented, notched, and jagged.

At six o'clock the travellers found themselves exactly over the north pole. They were quietly gazing at the rapidly shifting features of the wondrous view unrolling itself beneath them, and were silently wondering what was to come next, when, suddenly, the Projectile passed the dividing line. The Sun and Moon instantly vanished from view. The next moment, without the slightest warning the travellers found themselves plunged in an ocean of the most appalling darkness!