CHAPTER XVI.

THE SOUTHERN HEMISPHERE.

Exceedingly narrow and exceedingly fortunate had been the escape of the Projectile. And from a danger too the most unlikely and the most unexpected. Who would have ever dreamed of even the possibility of such an encounter? And was all danger over? The sight of one of these erratic bolides certainly justified the gravest apprehensions of our travellers regarding the existence of others. Worse than the sunken reefs of the Southern Seas or the snags of the Mississippi, how could the Projectile be expected to avoid them? Drifting along blindly through the boundless ethereal ocean, her inmates, even if they saw the danger, were totally powerless to turn her aside. Like a ship without a rudder, like a runaway horse, like a collapsed balloon, like an iceberg in an Atlantic storm, like a boat in the Niagara rapids, she moved on sullenly, recklessly, mechanically, mayhap into the very jaws of the most frightful danger, the bright intelligences within no more able to modify her motions even by a finger's breadth than they were able to affect Mercury's movements around the Sun.

But did our friends complain of the new perils now looming up before them? They never thought of such a thing. On the contrary, they only considered themselves (after the lapse of a few minutes to calm their nerves) extremely lucky in having witnessed this fresh glory of exuberant nature, this transcendent display of fireworks which not only

cast into absolute insignificance anything of the kind they had ever seen on Earth, but had actually enabled them by its dazzling illumination to gaze for a second or two at the Moon's mysterious invisible disc. This glorious momentary glance, worth a whole lifetime of ordinary existence, had revealed to mortal ken her continents, her oceans, her forests. But did it also convince them of the existence of an atmosphere on her surface whose vivifying molecules would render life possible? This question they had again to leave unanswered--it will hardly ever be answered in a way quite satisfactory to human curiosity. Still, infinite was their satisfaction at having hovered even for an instant on the very verge of such a great problem's solution.

It was now half-past three in the afternoon. The Projectile still pursued its curving but otherwise unknown path over the Moon's invisible face. Had this path been disturbed by that dangerous meteor? There was every reason to fear so--though, disturbance or no disturbance, the curve it described should still be one strictly in accordance with the laws of Mechanical Philosophy. Whether it was a parabola or a hyperbola, however, or whether it was disturbed or not, made very little difference as, in any case, the Projectile was bound to quit pretty soon the cone of the shadow, at a point directly opposite to where it had entered it. This cone could not possibly be of very great extent, considering the very slight ratio borne by the Moon's diameter when compared with the Sun's. Still, to all appearances, the Projectile seemed to be quite as deeply immersed in the shadow as ever, and there was apparently not the slightest sign of such a state of things coming soon to an end. At what rate was the Projectile now moving? Hard to say, but certainly not

slowly, certainly rapidly enough to be out of the shadow by this time, if describing a curve rigidly parabolic. Was the curve therefore not parabolic? Another puzzling problem and sadly bewildering to poor Barbican, who had now almost lost his reason by attempting to clear up questions that were proving altogether too profound for his overworked brains.

Not that he ever thought of taking rest. Not that his companions thought of taking rest. Far from it. With senses as high-strung as ever, they still watched carefully for every new fact, every unexpected incident that might throw some light on the sidereal investigations. Even their dinner, or what was called so, consisted of only a few bits of bread and meat, distributed by Ardan at five o'clock, and swallowed mechanically. They did not even turn on the gas full head to see what they were eating; each man stood solidly at his window, the glass of which they had enough to do in keeping free from the rapidly condensing moisture.

At about half-past five, however, M'Nicholl, who had been gazing for some time with his telescope in a particular direction, called the attention of his companions to some bright specks of light barely discernible in that part of the horizon towards which the Projectile was evidently moving. His words were hardly uttered when his companions announced the same discovery. They could soon all see the glittering specks not only becoming more and more numerous, but also gradually assuming the shape of an extremely slender, but extremely brilliant crescent. Rapidly more brilliant and more decided in shape the profile gradually grew, till it soon resembled the first faint sketch of the New

Moon that we catch of evenings in the western sky, or rather the first glimpse we get of her limb as it slowly moves out of eclipse. But it was inconceivably brighter than either, and was furthermore strangely relieved by the pitchy blackness both of sky and Moon. In fact, it soon became so brilliant as to dispel in a moment all doubt as to its particular nature. No meteor could present such a perfect shape; no volcano, such dazzling splendor.

"The Sun!" cried Barbican.

"The Sun?" asked M'Nicholl and Ardan in some astonishment.

"Yes, dear friends; it is the Sun himself that you now see; these summits that you behold him gilding are the mountains that lie on the Moon's southern rim. We are rapidly nearing her south pole."

"After doubling her north pole!" cried Ardan; "why, we must be circumnavigating her!"

"Exactly; sailing all around her."

"Hurrah! Then we're all right at last! There's nothing more to fear from your hyperbolas or parabolas or any other of your open curves!"

"Nothing more, certainly, from an open curve, but every thing from a closed one."

"A closed curve! What is it called? And what is the trouble?"

"An eclipse it is called; and the trouble is that, instead of flying off into the boundless regions of space, our Projectile will probably describe an elliptical orbit around the Moon--"

--"What!" cried M'Nicholl, in amazement, "and be her satellite for ever!"

"All right and proper," said Ardan; "why shouldn't she have one of her own?"

"Only, my dear friend," said Barbican to Ardan, "this change of curve involves no change in the doom of the Projectile. We are as infallibly lost by an ellipse as by a parabola."

"Well, there was one thing I never could reconcile myself to in the whole arrangement," replied Ardan cheerfully; "and that was destruction by an open curve. Safe from that, I could say, 'Fate, do your worst!' Besides, I don't believe in the infallibility of your ellipsic. It may prove just as unreliable as the hyperbola. And it is no harm to hope that it may!"

From present appearances there was very little to justify Ardan's hope. Barbican's theory of the elliptic orbit was unfortunately too well grounded to allow a single reasonable doubt to be expressed regarding the Projectile's fate. It was to gravitate for ever around the Moon--a

sub-satellite. It was a new born individual in the astral universe, a microcosm, a little world in itself, containing, however, only three inhabitants and even these destined to perish pretty soon for want of air. Our travellers, therefore, had no particular reason for rejoicing over the new destiny reserved for the Projectile in obedience to the inexorable laws of the centripetal and centrifugal forces. They were soon, it is true, to have the opportunity of beholding once more the illuminated face of the Moon. They might even live long enough to catch a last glimpse of the distant Earth bathed in the glory of the solar rays. They might even have strength enough left to be able to chant one solemn final eternal adieu to their dear old Mother World, upon whose features their mortal eyes should never again rest in love and longing! Then, what was their Projectile to become? An inert, lifeless, extinct mass, not a particle better than the most defunct asteroid that wanders blindly through the fields of ether. A gloomy fate to look forward to. Yet, instead of grieving over the inevitable, our bold travellers actually felt thrilled with delight at the prospect of even a momentary deliverance from those gloomy depths of darkness and of once more finding themselves, even if only for a few hours, in the cheerful precincts illuminated by the genial light of the blessed Sun!

The ring of light, in the meantime, becoming brighter and brighter, Barbican was not long in discovering and pointing out to his companions the different mountains that lay around the Moon's south pole.

"There is Leibnitz on your right," said he, "and on your left you can easily see the peaks of Doerfel. Belonging rather to the Moon's dark

side than to her Earth side, they are visible to terrestrial astronomers only when she is in her highest northern latitudes. Those faint peaks beyond them that you can catch with such difficulty must be those of Newton and Curtius."

"How in the world can you tell?" asked Ardan.

"They are the highest mountains in the circumpolar regions," replied Barbican. "They have been measured with the greatest care; Newton is 23,000 feet high."

"More or less!" laughed Ardan. "What Delphic oracle says so?"

"Dear friend," replied Barbican quietly, "the visible mountains of the Moon have been measured so carefully and so accurately that I should hardly hesitate in affirming their altitude to be as well known as that of Mont Blanc, or, at least, as those of the chief peaks in the Himalayahs or the Rocky Mountain Range."

"I should like to know how people set about it," observed Ardan incredulously.

"There are several well known methods of approaching this problem," replied Barbican; "and as these methods, though founded on different principles, bring us constantly to the same result, we may pretty safely conclude that our calculations are right. We have no time, just now to draw diagrams, but, if I express myself clearly, you will no

doubt easily catch the general principle."

"Go ahead!" answered Ardan. "Anything but Algebra."

"We want no Algebra now," said Barbican, "It can't enable us to find principles, though it certainly enables us to apply them. Well. The Sun at a certain altitude shines on one side of a mountain and flings a shadow on the other. The length of this shadow is easily found by means of a telescope, whose object glass is provided with a micrometer. This consists simply of two parallel spider threads, one of which is stationary and the other movable. The Moon's real diameter being known and occupying a certain space on the object glass, the exact space occupied by the shadow can be easily ascertained by means of the movable thread. This space, compared with the Moon's space, will give us the length of the shadow. Now, as under the same circumstances a certain height can cast only a certain shadow, of course a knowledge of the one must give you that of the other, and vice versa. This method, stated roughly, was that followed by Galileo, and, in our own day, by Beer and Maedler, with extraordinary success."

"I certainly see some sense in this method," said Ardan, "if they took extraordinary pains to observe correctly. The least carelessness would set them wrong, not only by feet but by miles. We have time enough, however, to listen to another method before we get into the full blaze of the glorious old Sol."

"The other method," interrupted M'Nicholl laying down his telescope to

rest his eyes, and now joining in the conversation to give himself something to do, "is called that of the tangent rays. A solar ray, barely passing the edge of the Moon's surface, is caught on the peak of a mountain the rest of which lies in shadow. The distance between this starry peak and the line separating the light from the darkness, we measure carefully by means of our telescope. Then--"

"I see it at a glance!" interrupted Ardan with lighting eye; "the ray, being a tangent, of course makes right angles with the radius, which is known: consequently we have two sides and one angle--quite enough to find the other parts of the triangle. Very ingenious--but now, that I think of it--is not this method absolutely impracticable for every mountain except those in the immediate neighborhood of the light and shadow line?"

"That's a defect easily remedied by patience," explained Barbican--the Captain, who did not like being interrupted, having withdrawn to his telescope--"As this line is continually changing, in course of time all the mountains must come near it. A third method--to measure the mountain profile directly by means of the micrometer--is evidently applicable only to altitudes lying exactly on the lunar rim."

"That is clear enough," said Ardan, "and another point is also very clear. In Full Moon no measurement is possible. When no shadows are made, none can be measured. Measurements, right or wrong, are possible only when the solar rays strike the Moon's surface obliquely with regard to the observer. Am I right, Signor Barbicani, maestro illustrissimo?"

"Perfectly right," replied Barbican. "You are an apt pupil."

"Say that again," said Ardan. "I want Mac to hear it."

Barbican humored him by repeating the observation, but M'Nicholl would only notice it by a grunt of doubtful meaning.

"Was Galileo tolerably successful in his calculations?" asked Ardan, resuming the conversation.

Before answering this question, Barbican unrolled the map of the Moon, which a faint light like that of day-break now enabled him to examine. He then went on: "Galileo was wonderfully successful--considering that the telescope which he employed was a poor instrument of his own construction, magnifying only thirty times. He gave the lunar mountains a height of about 26,000 feet--an altitude cut down by Hevelius, but almost doubled by Riccioli. Herschel was the first to come pretty close to the truth, but Beer and Maedler, whose Mappa Selenographica now lies before us, have left really nothing more to be done for lunar astronomy--except, of course, to pay a personal visit to the Moon--which we have tried to do, but I fear with a very poor prospect of success."

"Cheer up! cheer up!" cried Ardan. "It's not all over yet by long odds. Who can say what is still in store for us? Another bolide may shunt us off our ellipse and even send us to the Moon's surface."

Then seeing Barbican shake his head ominously and his countenance become more and more depressed, this true friend tried to brighten him up a bit by feigning to take deep interest in a subject that to him was absolutely the driest in the world.

"Meer and Baedler--I mean Beer and Maedler," he went on, "must have measured at least forty or fifty mountains to their satisfaction."

"Forty or fifty!" exclaimed Barbican. "They measured no fewer than a thousand and ninety-five lunar mountains and crater summits with a perfect success. Six of these reach an altitude of upwards of 18,000 feet, and twenty-two are more than 15,000 feet high."

"Which is the highest in the lot?" asked Ardan, keenly relishing Barbican's earnestness.

"Doerfel in the southern hemisphere, the peak of which I have just pointed out, is the highest of the lunar mountains so far measured," replied Barbican. "It is nearly 25,000 feet high."

"Indeed! Five thousand feet lower than Mount Everest--still for a lunar mountain, it is quite a respectable altitude."

"Respectable! Why it's an enormous altitude, my dear friend, if you compare it with the Moon's diameter. The Earth's diameter being more than 3-1/2 times greater than the Moon's, if the Earth's mountains bore

the same ratio to those of the Moon, Everest should be more than sixteen miles high, whereas it is not quite six."

"How do the general heights of the Himalayahs compare with those of the highest lunar mountains?" asked Ardan, wondering what would be his next question.

"Fifteen peaks in the eastern or higher division of the Himalayahs, are higher than the loftiest lunar peaks," replied Barbican. "Even in the western, or lower section of the Himalayahs, some of the peaks exceed Doerfel."

"Which are the chief lunar mountains that exceed Mont Blanc in altitude?" asked Ardan, bravely suppressing a yawn.

"The following dozen, ranged, if my memory does not fail me, in the exact order of their respective heights;" replied Barbican, never wearied in answering such questions: "Newton, Curtius, Casatus, Rheita, Short, Huyghens, Biancanus, Tycho, Kircher, Clavius, Endymion, and Catharina."

"Now those not quite up to Mont Blanc?" asked Ardan, hardly knowing what to say.

"Here they are, about half a dozen of them: Moretus, Theophilus, Harpalus, Eratosthenes, Werner, and Piccolomini," answered Barbican as ready as a schoolboy reciting his lesson, and pointing them

out on the map as quickly as a compositor distributing his type.

"The next in rank?" asked Ardan, astounded at his friend's wonderful memory.

"The next in rank," replied Barbican promptly, "are those about the size of the Matterhorn, that is to say about 2-3/4 miles in height. They are Macrobius, Delambre, and Conon. Come," he added, seeing Ardan hesitating and at a loss what other question to ask, "don't you want to know what lunar mountains are about the same height as the Peak of Teneriffe? or as Ætna? or as Mount Washington? You need not be afraid of puzzling me. I studied up the subject thoroughly, and therefore know all about it."

"Oh! I could listen to you with delight all day long!" cried Ardan, enthusiastically, though with some embarrassment, for he felt a twinge of conscience in acting so falsely towards his beloved friend. "The fact is," he went on, "such a rational conversation as the present, on such an absorbing subject, with such a perfect master--"

"The Sun!" cried M'Nicholl starting up and cheering. "He's cleared the disc completely, and he's now himself again! Long life to him! Hurrah!"

"Hurrah!" cried the others quite as enthusiastically (Ardan did not seem a bit desirous to finish his sentence).

They tossed their maps aside and hastened to the window.