CHAPTER XVI.

THE SOUTHERN HEMISPHERE.

The projectile had just escaped a terrible danger, a danger quite unforeseen. Who would have imagined such a meeting of asteroids? These wandering bodies might prove serious perils to the travellers. They were to them like so many rocks in the sea of ether, which, less fortunate than navigators, they could not avoid. But did these adventurers of space complain? No, as Nature had given them the splendid spectacle of a cosmic meteor shining by formidable expansion, as this incomparable display of fireworks, which no Ruggieri could imitate, had lighted for a few seconds the invisible nimbus of the moon. During that rapid peep, continents, seas, and forests had appeared to them. Then the atmosphere did give there its life-giving particles? Questions still not solved, eternally asked by American curiosity.

It was then 3.30 p.m. The bullet was still describing its curve round the moon. Had its route again been modified by the meteor? It was to be feared. The projectile ought, however to describe a curve imperturbably determined by the laws of mechanics. Barbicane inclined to the opinion that this curve would be a parabola and not an hyperbola. However, if the parabola was admitted, the bullet ought soon to come out of the cone of shadow thrown into the space on the opposite side to the sun. This cone, in fact, is very narrow, the angular diameter of the moon is so

small compared to the diameter of the orb of day. Until now the projectile had moved in profound darkness. Whatever its speed had been--and it could not have been slight--its period of occultation continued. That fact was evident, but perhaps that would not have been the case in a rigidly parabolical course. This was a fresh problem which tormented Barbicane's brain, veritably imprisoned as it was in a web of the unknown which he could not disentangle.

Neither of the travellers thought of taking a minute's rest. Each watched for some unexpected incident which should throw a new light on their uranographic studies. About five o'clock Michel distributed to them, by way of dinner, some morsels of bread and cold meat, which were rapidly absorbed, whilst no one thought of leaving the port-light, the panes of which were becoming incrusted under the condensation of vapour.

About 5.45 p.m., Nicholl, armed with his telescope, signalised upon the southern border of the moon, and in the direction followed by the projectile, a few brilliant points outlined against the dark screen of the sky. They looked like a succession of sharp peaks with profiles in a tremulous line. They were rather brilliant. The terminal line of the moon looks the same when she is in one of her octants.

They could not be mistaken. There was no longer any question of a simple meteor, of which that luminous line had neither the colour nor the mobility, nor of a volcano in eruption. Barbicane did not hesitate to declare what it was.

"The sun!" he exclaimed.

"What! the sun!" answered Nicholl and Michel Ardan.

"Yes, my friends, it is the radiant orb itself, lighting up the summit of the mountains situated on the southern border of the moon. We are evidently approaching the South Pole!"

"After having passed the North Pole," answered Michel. "Then we have been all round our satellite."

"Yes, friend Michel."

"Then we have no more hyperbolas, no more parabolas, no more open curves to fear!"

"No, but a closed curve."

"Which is called--"

"An ellipsis. Instead of being lost in the interplanetary spaces it is possible that the projectile will describe an elliptical orbit round the moon."

"Really!"

"And that it will become its satellite."

"Moon of the moon," exclaimed Michel Ardan.

"Only I must tell you, my worthy friend, that we are none the less lost men on that account!"

"No, but in another and much pleasanter way!" answered the careless Frenchman, with his most amiable smile.

President Barbicane was right. By describing this elliptical orbit the projectile was going to gravitate eternally round the moon like a sub-satellite. It was a new star added to the solar world, a microcosm peopled by three inhabitants, whom want of air would kill before long. Barbicane, therefore, could not rejoice at the position imposed on the bullet by the double influence of the centripetal and centrifugal forces. His companions and he were again going to see the visible face of the disc. Perhaps their existence would last long enough for them to perceive for the last time the full earth superbly lighted up by the rays of the sun! Perhaps they might throw a last adieu to the globe they were never more to see again! Then their projectile would be nothing but an extinct mass, dead like those inert asteroids which circulate in the ether. A single consolation remained to them: it was that of seeing the darkness and returning to light, it was that of again entering the zones bathed by solar irradiation!

In the meantime the mountains recognised by Barbicane stood out more and more from the dark mass. They were Mounts Doerfel and Leibnitz, which stand on the southern circumpolar region of the moon.

All the mountains of the visible hemisphere have been measured with perfect exactitude. This perfection will, no doubt, seem astonishing, and yet the hypsometric methods are rigorous. The altitude of the lunar mountains may be no less exactly determined than that of the mountains of the earth.

The method generally employed is that of measuring the shadow thrown by the mountains, whilst taking into account the altitude of the sun at the moment of observation. This method also allows the calculating of the depth of craters and cavities on the moon. Galileo used it, and since Messrs. Boeer and Moedler have employed it with the greatest success.

Another method, called the tangent radii, may also be used for measuring lunar reliefs. It is applied at the moment when the mountains form luminous points on the line of separation between light and darkness which shine on the dark part of the disc. These luminous points are produced by the solar rays above those which determine the limit of the phase. Therefore the measure of the dark interval which the luminous point and the luminous part of the phase leave between them gives exactly the height of the point. But it will be seen that this method can only be applied to the mountains near the line of separation of

darkness and light.

A third method consists in measuring the profile of the lunar mountains outlined on the background by means of a micrometer; but it is only applicable to the heights near the border of the orb.

In any case it will be remarked that this measurement of shadows, intervals, or profiles can only be made when the solar rays strike the moon obliquely in relation to the observer. When they strike her directly--in a word, when she is full--all shadow is imperiously banished from her disc, and observation is no longer possible.

Galileo, after recognising the existence of the lunar mountains, was the first to employ the method of calculating their heights by the shadows they throw. He attributed to them, as it has already been shown, an average of 9,000 yards. Hevelius singularly reduced these figures, which Riccioli, on the contrary, doubled. All these measures were exaggerated. Herschel, with his more perfect instruments, approached nearer the hypsometric truth. But it must be finally sought in the accounts of modern observers.

Messrs. Boeer and Moedler, the most perfect selenographers in the whole world, have measured 1,095 lunar mountains. It results from their calculations that 6 of these mountains rise above 5,800 metres, and 22 above 4,800. The highest summit of the moon measures 7,603 metres; it is, therefore, inferior to those of the earth, of which some are 1,000

yards higher. But one remark must be made. If the respective volumes of the two orbs are compared the lunar mountains are relatively higher than the terrestrial. The lunar ones form 1/70 of the diameter of the moon, and the terrestrial only form 1/140 of the diameter of the earth. For a terrestrial mountain to attain the relative proportions of a lunar mountain, its perpendicular height ought to be 6-1/2 leagues. Now the highest is not four miles.

Thus, then, to proceed by comparison, the chain of the Himalayas counts three peaks higher than the lunar ones, Mount Everest, Kunchinjuga, and Dwalagiri. Mounts Doerfel and Leibnitz, on the moon, are as high as Jewahir in the same chain. Newton, Casatus, Curtius, Short, Tycho, Clavius, Blancanus, Endymion, the principal summits of Caucasus and the Apennines, are higher than Mont Blanc. The mountains equal to Mont Blanc are Moret, Theophylus, and Catharnia; to Mount Rosa, Piccolomini, Werner, and Harpalus; to Mount Cervin, Macrobus, Eratosthenes, Albateque, and Delambre; to the Peak of Teneriffe, Bacon, Cysatus, Philolaus, and the Alps; to Mount Perdu, in the Pyrenees, Roemer and Boguslawski; to Etna, Hercules, Atlas, and Furnerius.

Such are the points of comparison that allow the appreciation of the altitude of lunar mountains. Now the trajectory followed by the projectile dragged it precisely towards that mountainous region of the southern hemisphere where rise the finest specimens of lunar orography.