Kodai Kanal. The slides just shown, like those they had recently of Halley's Comet, were very fine specimens of what was turned out, and he thought members were to be congratulated on having obtained such an asset to their meetings and publications.

The thanks of the meeting were then accorded to Mr. Evershed with applause.

Mr. Woodhouse showed some photographs of the moon he had taken at the Presidency College, and drew special attention to one of his slides which had been made by means of the wet process. The slide possessed a fine rich tone which was much admired.

Mr. Woodhouse then read a short paper on the adjustments necessary for an equatorial telescope.

The thanks of the meeting were accorded to Mr. Woodhouse for his slides and paper.

The meeting was adjourned until the 31st January 1911 at 5 p.m.

The Crater Plato as viewed by an Observer on the Moon.

By U. L. Banerji.

The entire surface of the moon visible to us is covered by numerous mountains, ridges, plains and craters. The latter class consists of formations, which, when seen through telescopes of low magnifying power, appear like the craters of volcanos on our earth, although they are really diverse in character, the like of which can hardly be seen here. Astronomers divide them into different classes, *viz.*, walled plains, mountainous rings, ring planes, craters, crater plains, etc., according to the size and nature of these formations. Those belonging to walled plain class generally vary from 40 to 150 miles in diameter, surrounded not by a single wall but generally by an intricate system of mountainous ranges united together by cross walls. These mountains are again separated by valleys and covered by numerous ravines. Towards the exterior and interior of these walled plains can be seen several projections or arms extending in different directions. Sometimes these extending arms unite more than one walled plain and then terminate in lofty peaks, and sometimes extend to great distances as mountainous ranges. The inside of these walled plains is often level; sometimes crater cones or ridges are visible here and there, occasionally terminating in low mounds in the middle.

The surrounding walls of these walled plains are not uniform in character. They sometimes terminate in elevated mountains throwing long shadows on the plains during the lunation period, which vary in size with the altitude of the sun. Sometimes long ranges of comparatively low mountains interspersed by valleys run out to great distances in different directions. Sometimes these walls form the boundaries of tablelands, the craters forming in fact bowl-shaped depressions in these high elevated lands.

The Crater Plato, which is the subject of our study this evening, belongs to this walled plain class. It is situated at -10° Long. and $+50^\circ$ Lat. On one side of it is Mare Imbrium, while on the other is Frigoris. Its diameter is about 60 miles. Its surrounding walls or ramparts, so to say, vary from 3,000 to 3,800 feet in height, the highest part (3,800 feet) being on the east, while the lowest part (3,000 feet) on the south. Beyond the walls on the east is the loftiest peak ξ 7,418 feet high, while on its opposite on the west are visible 3 lofty peaks γ, δ and ϵ, 7,238, 6,369, and 5, 128 feet high respectively. These peaks form the extremities of a series of mountainous ranges, which slope down from the walls all round, specially on the south-west, which forms a great belt of tableland covered by numerous hills and ridges. On the east is also a tableland sloping down from the peak ξ forming the southern part of the Mare Imbrium. This whole system of tableland carrying Plato in the middle separates Frigoris from Mare Imbrium, and ultimately terminate in the Alpine ranges on the west.

The floor of Plato is of dark steel colour which undergoes change with the elevation of the sun. Viewed on the 15th December 1910, 3 days before the full moon, it seemed dark grey in colour. There were also visible some light grey streaks and 2 or 3 small white round spots. Astronomers discovered that these spots form crater cones with bright steep exterior walls, and a minute central crater on the summit. These streaks are rather brighter near the border and close to these white spots.

Let us now consider what view these surrounding walls and peaks will give to an observer situated at different places of Plato's surface. It being like a plate with high borders, it may naturally seem that an observer standing in the centre will see the *entire* walls with peaks projecting over it, and it might be thought that he would realise himself to be inside a flat-bottomed bowl. But this is not so; the curvature of the moon's surface makes a great difference. It will obstruct the lower part of the walls, and the further he moves way from each wall, the greater will be the portion of the wall disappearing from his sight.

Taking the radius of the moon as γ miles, α the distance of the observer from the wall in miles and h the height of the wall in feet invisible to him, we may find out the value of h geometrically in terms of γ and α thus :—

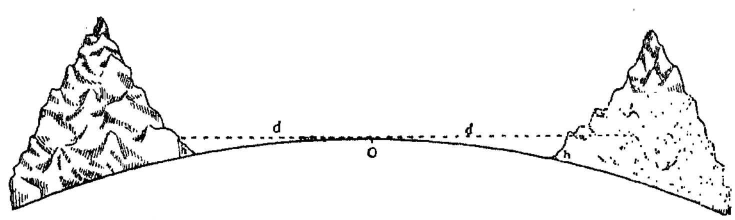
$$\frac{h}{1760 \times 3}\left(\frac{h}{1760 \times 3} + 2\,r\right) = d^2$$

Now the radius of the moon as 1,080 miles, so we get

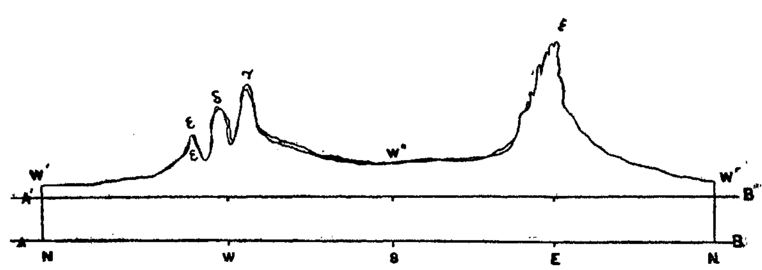
$$\frac{h}{1760 \times 3}\left(\frac{h}{1760 \times 3} + 2160\right) = d^2$$

or $h = 2{\cdot}44\, d^2$

Now if the observer stands at the centre, the walls would be about 30 miles distant from him. The value of h would then be 2,176 or say 2,200 feet, that is, in other words, he will not see 2,200 feet of the walls from the ground and the walls around will appear to him as only 800 to 1,600 feet high. If the crater is divided by a plane perpendicularly passing through the centre, the portion seen will be above the dotted line. The portion of the walls below the dotted line will not be visible to him.

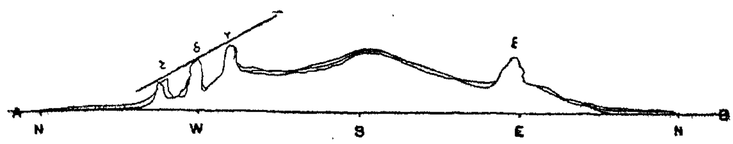


Spreading out the surrounding walls in a straight line its height at different places and the heights of the peaks beyond may be graphically shown thus :—



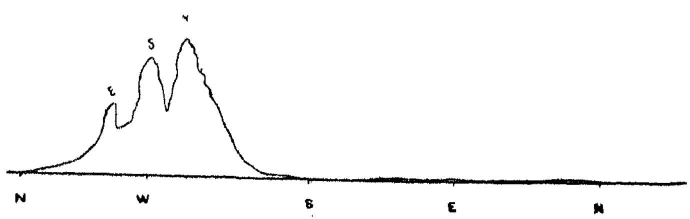
A B is the plane or crater.
W′ W″ W′ is the wall spread out in a line.
A A′ and B B′ =22,000 feet obstructed from his view.
The observer will only see A′W′ to B″W″ portion and the peaks above.

If he moves towards the south wall he will gradually have the full view of it, while the walls on the north at his back and those on his sides at the east and west will gradually disappear and their peaks only be visible. The view of the walls may be graphically shown as below :—



Here the mountain peaks will appear to him nearly of the same height as the wall before him, although they are higher than the walls at their feet, while no portion of the wall on the north will be visible to him. He will only see the flat bottom of the crater in that direction.

If he now moves to the west wall only the 3 peaks, ε δ and γ and the walls below will come full into his view, while the walls on the north and south, as well as the highest peak ξ on the east, will disappear altogether. The view will be as below :—



The same thing will happen if he goes to the east wall.

If he moves to the north wall at last he will have the view of other walls as below :—

Thus if he moves about from place to place within the crater, the walls on one side will come to his view, while those on the other will appear lower and lower and then disappear below the horizon, and he will hardly imagine that he is within a bowl-shaped enclosure surrounded by a wall.

Had the crater been upon the earth, whose curvature is not so large, only about 600 feet (instead of 2,200 feet) of the walls would have been invisible to him from his position at the centre. Standing at the extreme ends he would have a gradually sloping view of the walls, which would just become invisible at the opposite end.

Illumination of the Moon's Disc during a Total Lunar Eclipse.

BY DR. E. P. HARRISON.

The following short note has arisen out of a discussion which occurred after the last meeting of the Society. It was subsequently thought that a few remarks on the subject of the illumination seen over the moon's disc during a total eclipse might not be without interest to some of the members. The usual diagrams given in text-books of a total Eclipse of the moon make clear the state of affairs during a total eclipse. They show the arrangement of the three bodies involved, and indicate the extent of the shadow when the earth is considered to possess no atmosphere. It is seen that the moon is completely in shadow, and apart from resultant illumination due to starlight, should be invisible from the earth.

The " radius of the shadow" may especially be noticed as being an important factor in the determination of the length of an eclipse. Its maximum value in any possible eclipse is $1^\circ\ 2'$ of arc.

Now suppose that, by some means or another, a portion of the light of the sun as it passes immediately over the earth's surface is bent inwards towards the centre of the moon, the effect is obviously that a certain amount of illumination is shed over the eclipsed disc, rendering the latter visible from the earth.

The existence of our atmosphere supplies us with a cause for the necessary bending, and consequently, with a perfectly satisfactory reason for the illumination observed during totality. It is only necessary now to calculate the *amount* of the refraction produced by the layer of air over