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Tapping, Ken

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A LUNAR COVERUP

Ken Tapping, 6th February, 2018

On 31 January the Moon passed through the Earth's shadow, an event called a lunar eclipse. Under these circumstances we might expect the Moon to just vanish. However, usually, while it is in the Earth's shadow, it glows dimly with a beautiful copper colour. This spectacle is mostly due to our world's atmosphere, but is beautiful none the less.

While passing through the Earth's shadow, with the sunlight blocked out, we would expect the Moon to just become invisible. However, sunlight passing through the Earth's atmosphere is bent inward around the Earth and onto the Moon. When sunlight passes through a huge thickness of atmosphere, as it does at sunset, the blues and greens get filtered out, leaving only the reds and oranges. So the sunlight focused on the Moon is mostly red. If we were on the Moon we would see the Earth as a dark disc surrounded by a thin, bright, red ring. However, lunar eclipses are not only spectacular, they are opportunities to learn about the Moon's surface and what lies immediately below it.

The Moon has almost no atmosphere, and the rock samples brought back to Earth by the Apollo astronauts show the surface to be very dry, although there is evidence of ice on or below the surface in some places. As anyone who has visited a desert will have experienced, although it is appallingly hot during the day, it can get horribly cold at night. This is due to the sand and soil being dry, so that it retains little heat. Moreover, a dry atmosphere and no clouds do little to stop that heat radiating off into space. The daily temperature changes on the Moon are even worse: about 100 C during the lunar day, falling to far below zero at night. However, a lunar day is about 28 of ours, so these changes happen slowly. On the other hand, during an eclipse, the Sun's heat is cut off very quickly, providing an excellent opportunity for us to study the Moon's surface and what lies below it.

The Moon emits no light of its own. We see it because of the sunlight it reflects. However, it produces longer-wavelength radiation, such as infrared and radio waves. We can detect these with our optical and radio telescopes. The infrared comes from the Moon's surface. The longer-wavelength emissions come from beneath. The longer the wavelength the deeper down we see. During an eclipse the Sun's heat is rapidly blocked, and after a while equally rapidly restored. By mapping the emissions at many different wavelengths we can measure the temperature at various depths and how they change with time. From these observations we can tell how dusty the lunar soils are, how far down we hit bedrock, and also if there is any ice or moisture. This information is useful for two reasons, firstly it tells us about the Moon, and secondly, how difficult it will be for us to live on the Moon for long periods.

When we establish a permanent base on the Moon, we will be able to avoid those drastic temperature variations occurring on the lunar surface by building the base underground, at a depth where the temperature does not vary. Locally available water would be invaluable. Shipping water from Earth with the space technology we have today would be extremely expensive. Moreover, using the copious supply of solar energy we would also be able to extract from that water the oxygen we need to breathe.

Plans to establish a permanent base on the Moon are being discussed more and more seriously as our technologies improve, and at some point in the not too distant future, it is very likely someone will actually observe a lunar eclipse from the Moon.

Jupiter and Mars rise in the early hours. Saturn lies low in the dawn twilight. The Moon will be New on 14 February.

Ken Tapping is an astronomer with the NRC's Dominion Radio Astrophysical Observatory, Penticton, BC, V2A 6J9.

Tel (250) 497-2300, Fax (250) 497-2355

E-mail: ken.tapping@nrc-cnrc.gc.ca