

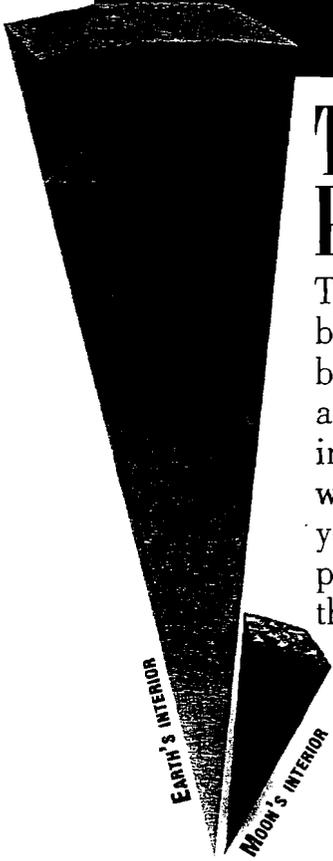


# The Moon— Past and Present

There are many theories about the birth of the Moon. Most scientists believe that 4.5 billion years ago, a small planetary body smacked into Earth. At the time, our planet was still young—just 100 million years old! The collision threw pieces of debris into orbit, which then joined together and became the Moon. Both Earth and the Moon spent the next 700 million

years under siege from giant meteorites. Earth's scars from that time have mostly healed, thanks to weather, erosion, and plant life. But the Moon still bears huge pockmarks, which we call craters.

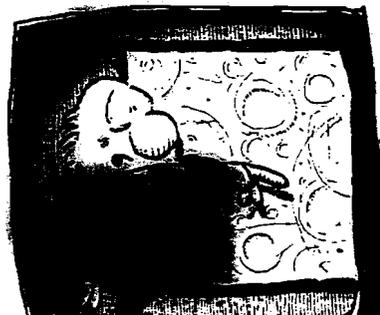
The final stage in the Moon's formation occurred over the next two billion years. Molten lava seeped up from beneath the surface, forming dark areas, now called maria, or seas. As this activity decreased, the Moon's surface hardened into the grayish-green crust we see today.



▲ **SCIENTISTS ARE** not exactly sure what lies beneath the Moon's hard outer crust. They believe there is a

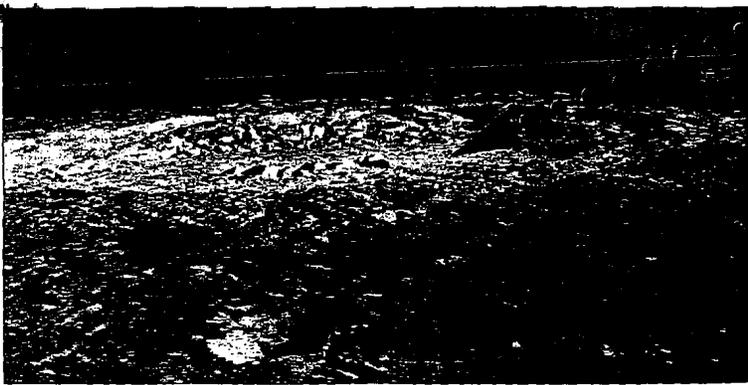
mantle, made of a dark rock, then a partly molten region, and finally a small core probably made of iron.

...and it looks like there's a chance, no, wait. Hmm...maybe we'll see some of those...ummm. Huh? Or perhaps a...



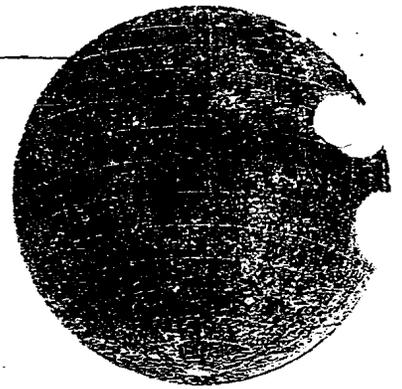
◀ **A TYPICAL** weather report from the Moon would be brief. There is no weather on the Moon—no clouds and little or no atmosphere (the gases that surround a planet).

The sky is always black and starry, and there is only a whisper of wind, caused by the Sun. That is why craters created billions of years ago remain practically unchanged.

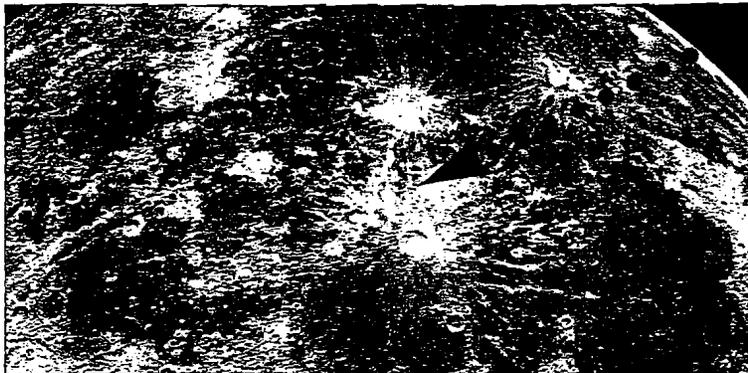


● **CRATERS**

There are billions of craters on the Moon. The largest is about seven hundred miles wide. The smallest are called micro-craters and are caused by cosmic dust.



▲ **NO LIFE EXISTS** in the Moon's dusty soil, which is called regolith. But minerals exist, including aluminum, iron, and titanium. Astronauts brought back three main types of rocks. Basalts (blue, above) are dark, hardened lava. Anorthosites (red, above) are light rocks in the highlands. Breccia are composites, made when other rocks were crushed together during meteorite impacts.



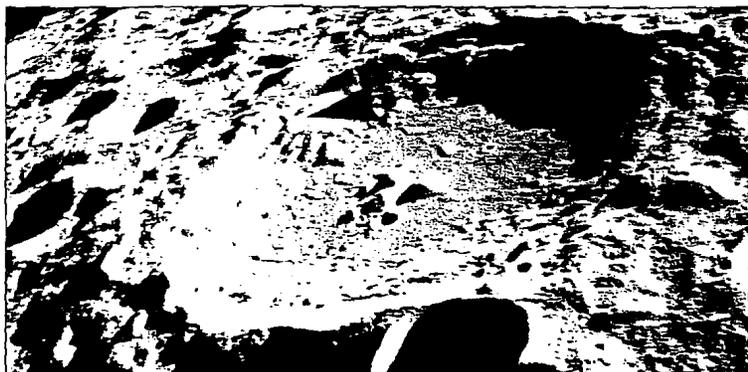
● **RAYs**

Meteors, comets, and asteroids can hit the Moon with the force of many atomic bombs, causing debris to splash out of the craters and form gray streaks called rays. They can be a thousand miles long.



● **MARIA (MA-REE-UH)**

These dark "seas" (some early astronomers thought they were water) make up 30 percent of the Moon's surface. Maria is actually lava that solidified after oozing from the Moon's crust.



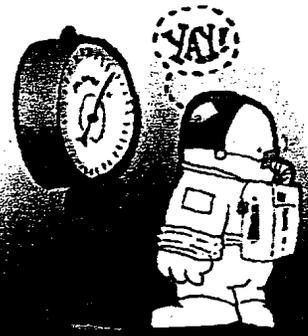
● **HIGHLANDS**

These appear light-colored from Earth. The few mountains are believed to be remnants of the walls of giant craters.



● **RILLES**

These are long narrow valleys. Some were caused by cracks in the Moon's crust and others by flowing lava.



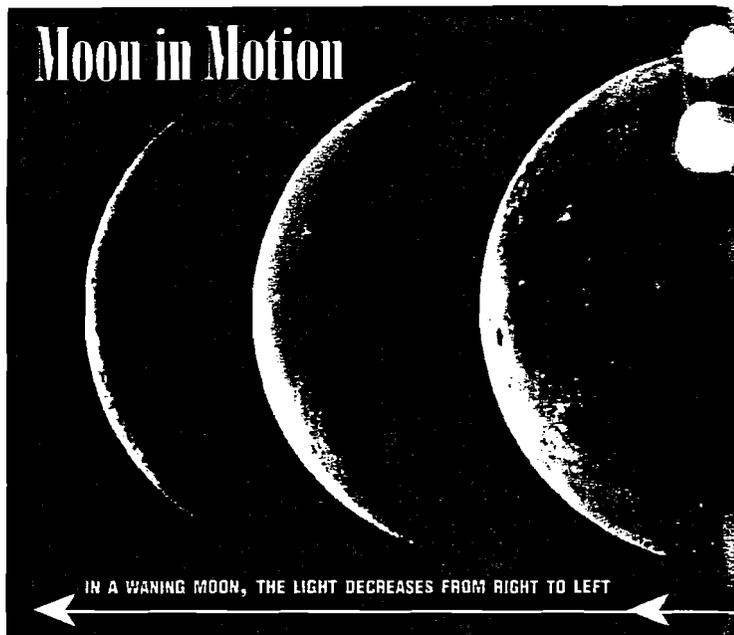
▲ **THE GRAVITY ON** the Moon is one-sixth that on Earth. So a 180-pound person weighs only 30 pounds on the Moon. That's good news because the bulky spacesuits needed for astronauts to stay alive would otherwise be very heavy.

# Reflected Glory

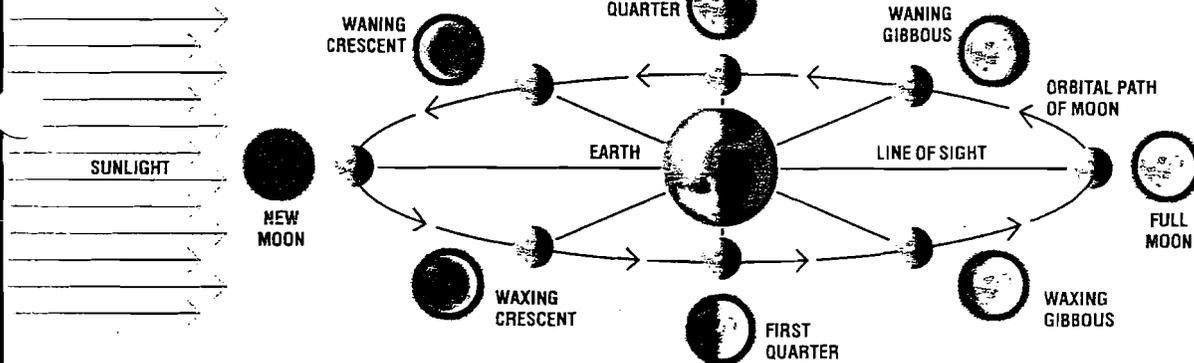
The Moon does not produce its own light. Instead, it reflects light from the Sun. However, the dusty lunar surface reflects only about 12 percent of the Sun's rays. But that is enough to make the Moon shine brightly, although we don't see all of it from Earth all the time.

➤ **WE SEE ONLY THE** part of the Moon that is lit by the Sun. During a Full Moon, the Sun is shining directly on the Moon. At all other times, Earth is in the way, so only part of the Moon can be seen. The Moon waxes (grows) while going from New Moon (dark) to Full Moon. It wanes (decreases) when going from a Full Moon to a New Moon.

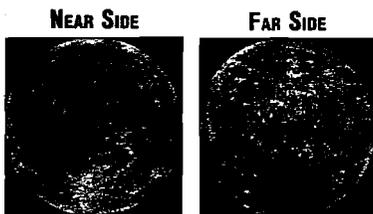
## Moon in Motion



## Phases of the Moon

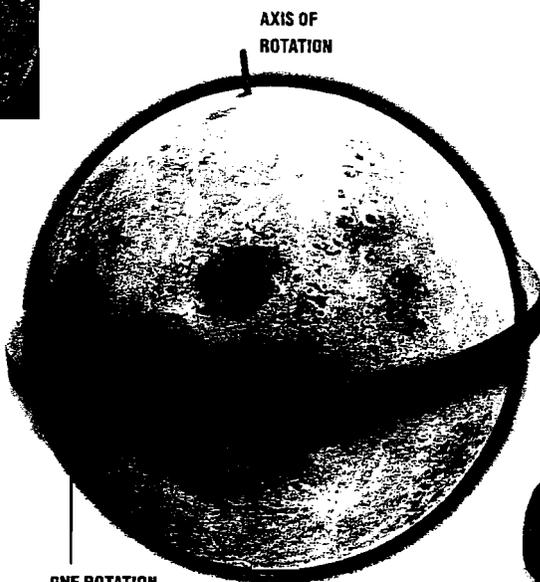


◀ **EARTH ORBITS** the Sun while the Moon orbits Earth in an elliptical, or oval, orbit. Because our view of the sunlit part of the Moon changes as the Moon circles Earth, the shape of the Moon seems to change. These changes are called phases. A complete phase cycle takes an average of 29.5 days, from one New Moon to the next. The difference between the time it takes the Moon to complete a phase and the time it takes it to rotate Earth is due to the relationship of the Moon to the Sun. (The Moon has to move the extra days to catch up with the moving Sun.)



## Rotation of the Moon

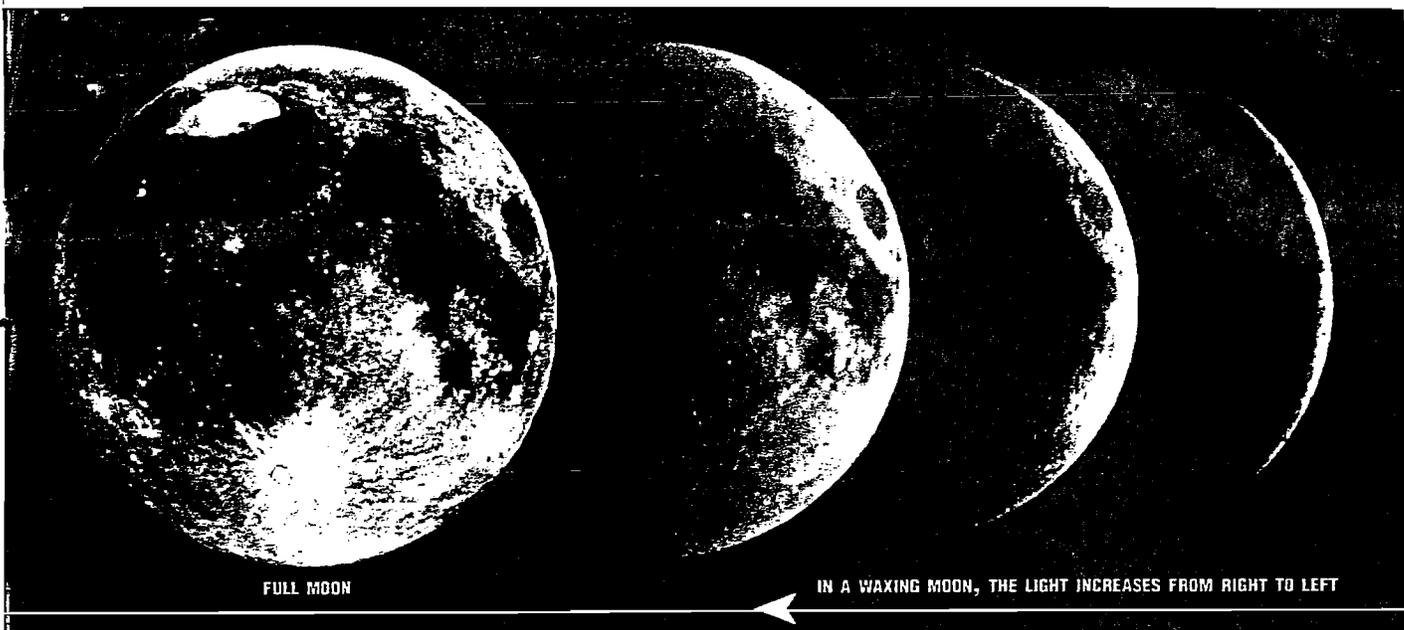
➤ **THE TIME THE** Moon takes to turn on its axis and the time it takes to orbit Earth are equal—27.32 days. Thus, the Moon is in a synchronous rotation with Earth, so one side of the Moon, called the near side, always faces Earth. The part of the Moon we can't see is called the far side.



**ONE ROTATION TAKES 27 EARTH DAYS AND 8 HOURS**

▼ **A NEW MOON** is the phase of the Moon in which it is nearly or totally invisible from Earth. When the Moon is between Earth and the Sun, the light from the Sun falls on the far side of the Moon. The side that faces Earth is dark, so we can't see the Moon.





FULL MOON

IN A WAXING MOON, THE LIGHT INCREASES FROM RIGHT TO LEFT

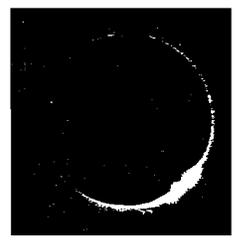
# Eclipses

Every so often, part or all of one heavenly body is hidden from view by the shadow of another. This is called an eclipse. A solar eclipse occurs when the Moon blocks the Sun's light from some area on Earth. A lunar eclipse occurs when Earth blocks the Sun's light from the Moon. Eclipses occur only when the Moon crosses Earth's orbital plane at a time when the Sun, Moon, and Earth are aligned (at a New Moon or a Full Moon).



**TOTAL SOLAR ECLIPSE**

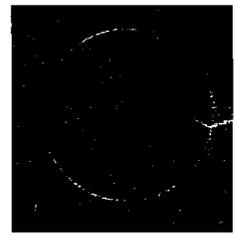
The Moon blocks out the entire Sun, except for a faint halo of light called a corona.



**ANNULAR ECLIPSE**

When the Moon is at a far point in its orbit of Earth, it cannot totally

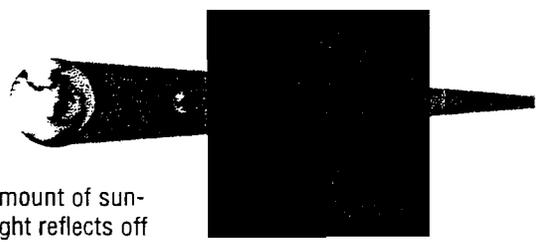
block the Sun. This leaves an annulus, or ring, that is brighter than a corona.



**TOTAL LUNAR ECLIPSE**

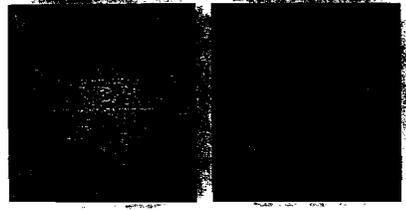
The Moon moves into Earth's shadow (umbra). The Moon seldom disappears completely during a lunar eclipse. Instead, it usually turns red. A small

amount of sunlight reflects off Earth, refracts (or bends) in the atmosphere, and then bounces off the Moon.



**PARTIAL SOLAR ECLIPSE**

The Moon covers only part of the Sun.



**PARTIAL LUNAR ECLIPSE**

The Moon passes through part of Earth's shadow.