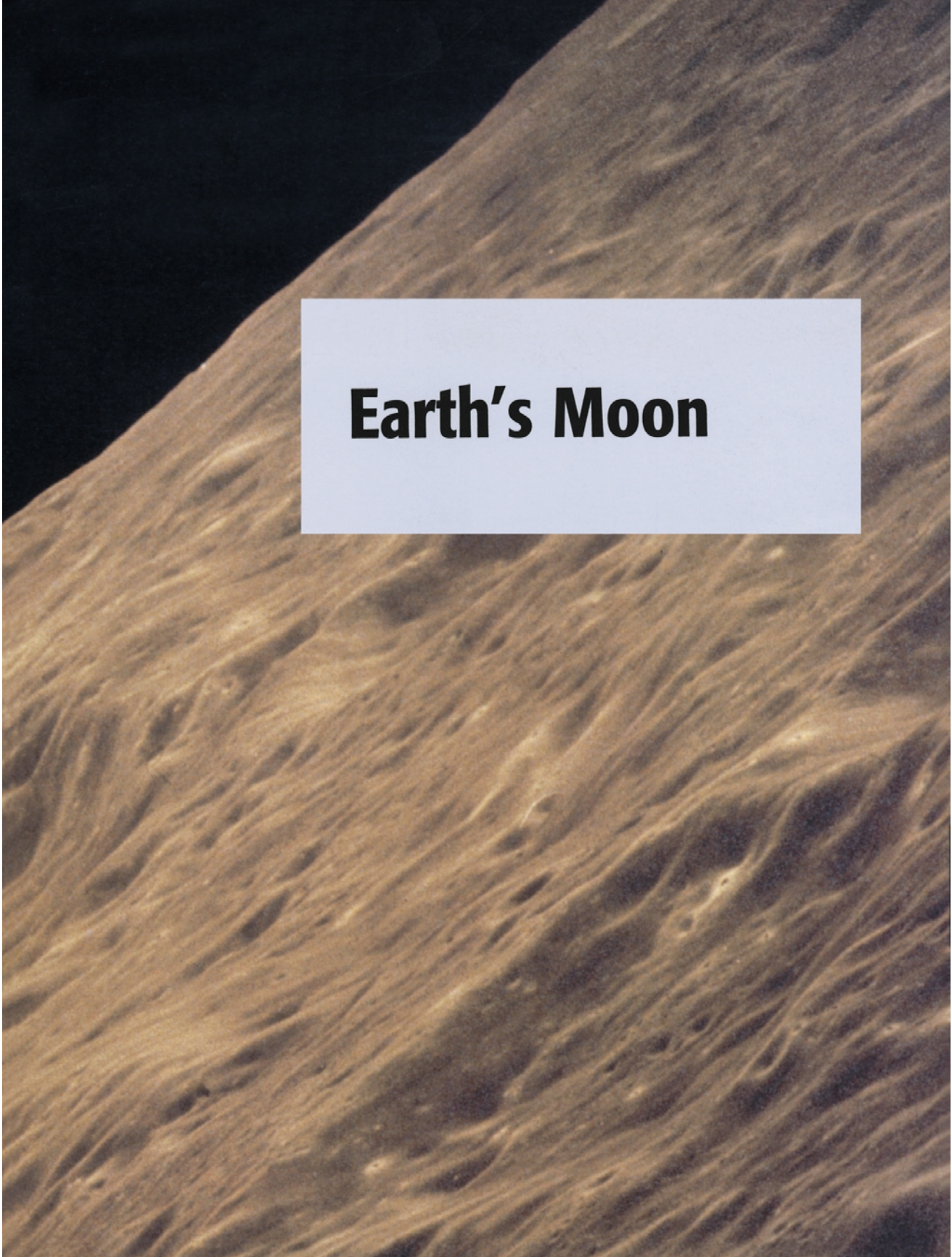


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# Earth's Moon



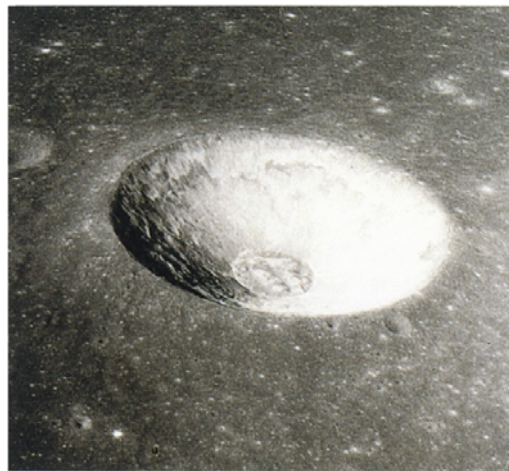
## What is there to see on the Moon?

*Even the unaided eye gives a hint of what the lunar surface is like. Large dark patches can be made out, which early observers called 'seas', with brighter areas, known as 'highlands', between them. The practised eye can even make out a few bright spots within the seas.*

### Waterless seas

The Moon's surface is characterised by its 'seas' or maria, so named by the early astronomers who saw them as the counterparts of the Earth's oceans. We now know, though, that the maria contain no water in liquid form. They are vast, mostly flat expanses of basalt some 3.8 to 3.1 billion years old. They cover 17% of the lunar surface and very many more of them lie on the near side than on the far side of the Moon.

These maria are probably the result of giant meteorites striking the Moon some 600 million years after it first began to form.



*The lunar maria are pitted with numerous craterlets like this one.*

### WHERE DOES THE MOON COME FROM?

There are a number of theories about how our satellite originated:

- Roche's 1873 'double-planet hypothesis' by which the Moon accreted from the same cloud of dust as the Earth.
- The 'fission hypothesis' that it formed by a bulge of soft material spinning off from the still-molten primitive Earth as proposed by George Darwin in the 1880s.
- The 'capture hypothesis'. A suggestion first made by Lee in 1909 is that the Moon formed beyond the orbit of Uranus, moved closer to Earth because it was slowed by dust particles cluttering the solar system and was finally captured.
- The 'giant impact hypothesis' according to which it was torn off the Earth as suggested by Hartmann and Davis in 1974. This theory is based on the composition of lunar rocks brought back by the Apollo and Luna missions because they contain terrestrial elements and 'extraneous' elements. It is thought that the Moon was produced by a collision between the newly formed Earth and a mini-planet in formation some 4 billion years ago. The impact supposedly tore debris from the Earth which mixed with the material of the planetoid to form the Moon.



It is thought that these meteorite strikes pierced the primitive crust causing the still-molten rocky mantle to spill out over the surface.

### Marine ridges

The maria are made up of basaltic lava with high proportions of iron, titanium and magnesium. Their surfaces are often ridged by very elongate, low hills known as 'dorsa' or 'wrinkle ridges', which sometimes branch out. Although only a hundred or so metres high, wrinkle ridges may extend for several thousand kilometres. They are thought to have formed by compression of the terrain as the surfaces of the maria cooled.

### Gently sloping mountains

The Moon has many mountains that are the remains of the primitive crust. There are also entire mountain ranges which are the rims of the impact basins where the maria formed. Lunar mountains slope gently at gradients of 15–20°, very occasionally reaching 30–35°.



- Craters proper range from 10 to 100 km across. They have three separate parts: the outer slopes, the inner wall and the floor. The outer slopes are made up of ejecta and rise gently from the surrounding terrain to the often steep crater rim. The inner wall has ledge-like terraces in craters wider than 50 km. The floor is often flat

*The Apollo missions confirmed that the lunar mountains were smooth and rounded.*

Some 20 or so mountain ranges have been catalogued.

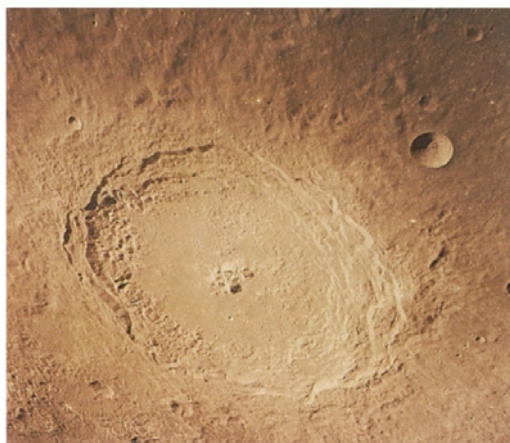
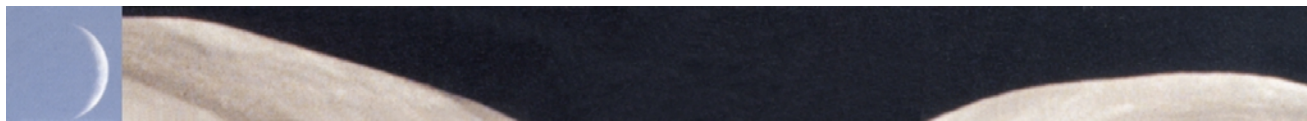
There are also isolated mountains, generally occurring as peaks emerging from the lava of the maria. They are remnants of the initial underlying surface before it was covered by the molten basalt. About 15 isolated mountains are recorded.

### Countless craters

The most characteristic features of the lunar surface are the countless meteorite craters ranging in size from 300 km down to less than 1 m in diameter. The near side of the Moon has more than 300 000 craters of more than 1 km in diameter.

A distinction is made by size between walled plains, classical craters and craterlets, but it is sometimes difficult to know quite which category to classify a formation in.

- Walled plains are large, often dilapidated and deformed mountainous rings of anything from 100 to 300 km in diameter. Their floors, which are often flat with many craters, craterlets, ridges and hills, sometimes follow the curvature of the Moon.



*Close-up of a large crater clearly showing the gently dipping outer slopes, the slumped terraces of the crater wall and its rather rugged floor with a central peak.*

with one or more central peaks or sometimes an inner ring of mountains. It is commonly cluttered by material or may be scarred by narrow, branching rilles.

- Craterlets are very prominent circular formations no more than 10 to 20 km across, with bowl-shaped floors.

### Crater chains

Although rare, a few crater chains are found

on the Moon. It is highly likely that all the craters in a chain were formed by the same event since there is a very low probability of a dozen or so craters forming a regular alignment over the course of time. Crater chains are thought to result from impacts from a single meteorite that broke up into a number of pieces just before striking the Moon.

### Enigmatic clefts

Rilles are another typical formation. They are sometimes sinuous, branching furrows running for several hundred kilometres. Comparisons with the few specimens found on Earth suggest that they are ancient underground tunnels that once conveyed lava but whose roofs have since collapsed.

Other straighter clefts are grabens formed where plates of the lunar crust have moved apart.

### Spectacular scarps

The lunar surface counts a handful of magnificent tectonic faults that show up marvellously when illuminated at a low angle when near the terminator. They rise to a few hundred metres and may be more than 100 km long. They are never sheer; indeed, most of them dip at less than 45°.

### DON'T FORGET YOUR SPACESUIT!

The Moon has only a pseudo-atmosphere composed of traces of helium from the degassing of rocks and from their erosion by the solar wind. Atmospheric pressure is not even one-millionth of the Earth's. A number of phenomena support this hypothesis: the edge of the Moon appears very sharply with no blurring; the terminator has no twilight zone; no clouds hide the Moon's surface; stars vanish instantly behind the Moon's disc when occulted. This absence of any atmosphere has a number of consequences: there is no water, no wind and no noise; the sky is not blue but black, with the Sun shining beside the coloured stars and the blue-tinted Earth; temperatures are extreme (from +100 °C in daytime to -150 °C at night); there are no shooting stars but meteorite falls; there is a constant rain of micro-meteorites (several tens of tonnes of dust per day).