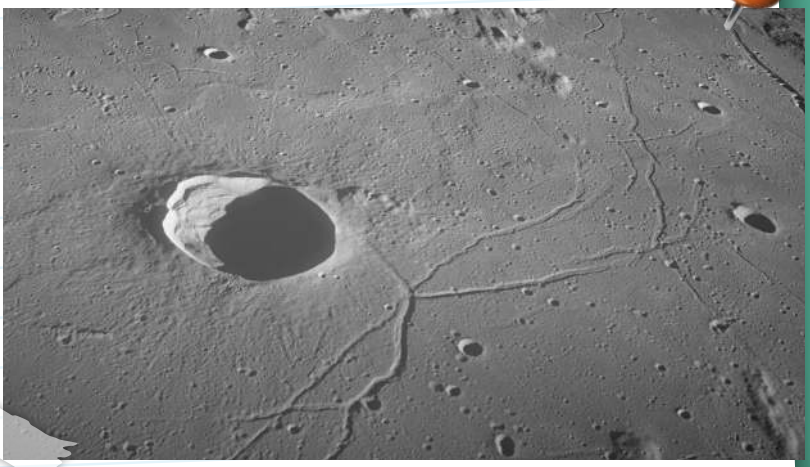
TEACHER RESOURCE

SCIENCE CONTENT/ CURRICULUM LINK
EARTH SYSTEMS / ASTRONOMICAL SYSTEMS

STARDOME OBSERVATORY & PLANETARIUM
FACTS, RESOURCES AND ACTIVITIES ON...

MOON GEOLOGY

A BATTERED HISTORY



The Trienecker crater, seen by the Apollo 10 mission in orbit above the Moon.

Our Moon is a vastly different world to ours. The surface is covered in thousands of craters, mountains ranges, and seas of cooled lava. The complex geology and topography of our Moon is owed to its unique formation and history spanning billions of years. The Moon is believed to have formed when a Mars-sized object impacted Earth around 4.5 billion years ago. The ensuing debris that was ejected into space from this impact coalesced over time, forming our Moon. It is made from many of the same rocks and minerals as Earth but it has a major difference... it does not have an atmosphere!

The Aitken Basin on the Moon's south pole is one of the largest craters in our Solar System at over 2,500km across. China landed its Chang'e 4 (named after the Chinese Moon goddess) spacecraft here in 2019.

Earth is protected by our thick atmosphere which burns up most small impacting asteroids and debris from space. Because the Moon does not have an atmosphere, asteroids frequently impact and crater its surface. There is nothing to slow down and burn up these asteroids. The lack of atmosphere also means that there is no weather, rain or wind. With nothing to erode the Moon's surface, many of its craters we see are billions of years old dating back to its early formation. There are no active plate tectonics on our Moon either. In contrast, Earth does not have many visible impact craters because they have eroded over time by weather and tectonic activity.

A distinct feature on the Moon is large, relatively flat regions of dark matter known as mare (Latin for 'seas'). These seas are not filled with water like on Earth but rather dark basalt plains of cooled lava. Most of the mare on our Moon are impact craters that filled with basalt billions of years ago when it was geologically active. Humans famously took their first steps on one of these seas, known as Mare Tranquillitatis (Sea of Tranquility) in July of 1969. In contrast to these dark seas, the Moon also has bright, higher elevated regions simply known as the 'highlands'. Most of the highlands are much older than the mare, which explains why they are more heavily cratered.

One of the most famous features of our Moon is the Tycho crater named after the Danish astronomer Tycho Brahe. Tycho is easily visible to the naked eye from Earth as a bright spot with large 'rays' of white matter streaking away from it. These are known as ejecta rays; matter that is thrown out and away from a crater during impact. Some of these rays stretch over 1,500km in length. Tycho would be large enough to stretch from Auckland to Hamilton at over 85km across and with a depth of almost 5km. Tycho is also a relatively young crater estimated to have formed about 108 million years ago, meaning that this impact event would have been visible to the dinosaurs from Earth!

The Moon today remains largely unchanged and it retains much of its geological history. Studying bodies like this are vital in helping astronomers understand how our Solar System's planets and moons formed eons ago.

Check out these other resources...

- An interactive Moon map: moon3dmap.com/#bookmark
- NASA's information on the Moon: nasa.gov/moon

DISCUSSION POINTS

Why are there so many craters still visible on our Moon?

What causes streaks on the Moon?

What causes the dark regions on our Moon?

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ACTIVITY

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MOON CRATERS

Make your own lunar craters with ejecta patterns.
We recommend doing this outside as it can get messy!

ACTIVITY ONE

Explore ejecta patterns and impact angles.

WHAT YOU'LL NEED

- Flour
- A flat/wide container to hold the flour
- Cocoa powder
- Sieve
- Small rocks/marbles

WHAT TO DO

1. Fill the flat container with flour ensuing it is at least 3cm deep all around.
2. Pour a small amount of cocoa powder through the sieve, sprinkling it over the flour to create a thin layer on top.
3. From a height of at least 1m, drop your srocks into the cocoa flour mix and see what happens!

Depending on how high you drop your rocks into the cocoa, you should see that the impact events uncover the bright flour underneath, creating ejecta patterns just like the Tycho crater on our Moon. Experiment with different speeds and angles of impact to see how different they look.

ACTIVITY TWO

Replace the rocks/marbles with your own coloured Moon meteors. You will be able to see how the meteor breaks up on impact, along with the ejecta lines.

WHAT YOU'LL NEED

- Flour
- Water
- Food colouring
- The same flour and cocoa powder container from Activity One

WHAT TO DO

1. Take a small amount of flour and drop a few drops of water in to solidify the flour.
2. Repeat this process until the flour and water is solid enough to hold, creating a 'Moon meteorite'.
3. Take a few drops of food colouring and add this to your Moon meteorite until it is sufficiently coloured.

Throwing this at the flour will cause the meteorite to break up on impact. You can see how this spreads out over the surface by tracing the colours across the flour. This is how our Moon has bright ejecta rays caused by impact events.

Source: NASAJPL Edu

TAKE A PHOTO OF YOUR ACTIVITY AND SEND IT TO US.
WE'D LOVE TO SEE IT! EDUCATION@STARDOME.ORG.NZ

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