



AMERICAN
FARM SCHOOL
Thessaloniki Greece

2.Mountains

REPORT
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The Problem

What are the tallest mountains in the Solar System?
Propose and analyze the theoretical models
that can allow predicting the maximum altitudes of
mountains on various celestial bodies.

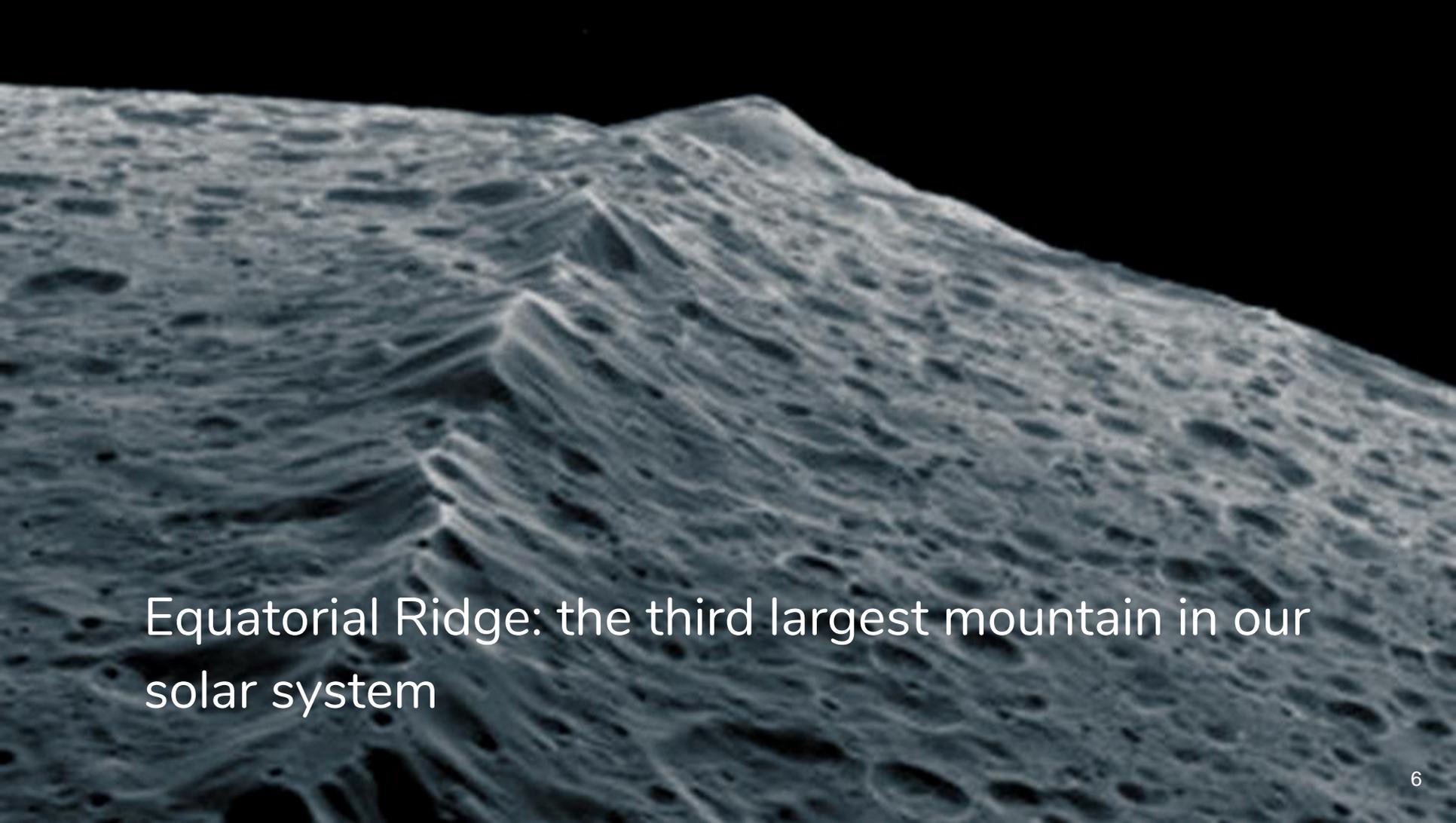
Definition

- A mountain is defined as "a natural elevation of the earth surface rising more or less abruptly from the surrounding level and attaining an altitude which, relatively to the adjacent elevation, is impressive or notable.
- **Mountains are formed** through **tectonic forces** or **volcanism**. These forces can locally raise the surface of the earth.

Mountains in our solar System

Equatorial Ridge, Saturn's Moon Iapetus 20 km
(12.4 mi)

- Some of its peaks reaching over 12 miles high.
- It could be caused by a previous ring system
- It might have occurred due to an ancient convective turn
- It could be composed of icy material pushed up from underneath
- It could be a result from when the moon was spinning more rapidly when it was younger.



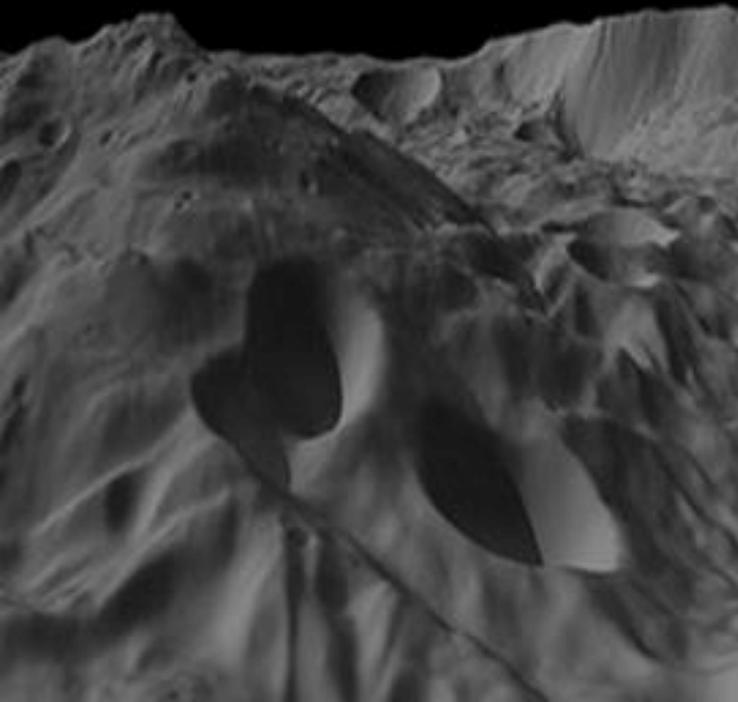
Equatorial Ridge: the third largest mountain in our solar system



Olympus Mons, Mars \approx 22 km (13.7 mi)

-
- About twice as tall as Earth's Mount Everest.
 - Olympus Mons is the result of many thousands of highly fluid, basaltic lava flows that poured from volcanic vents over a long period of time.

Rheasilvia Mons, 4
Vesta Asteroid – 23
km (14.2 mi)



- The largest mountain in our solar system, Rheasilvia, resides on the asteroid known as Vesta.
- Vesta is the second largest asteroid that orbits our Sun
- Rheasilvia rises 14.2 miles from it's surface terrain basin from an impact collision that is believed to have excavated 1 percent of its volume.

What affects the altitude of a mountain ?



In general, the maximum size of a mountain on a planet will be limited by surface gravity. The greater the surface gravity, the smaller the biggest mountain can be.

As a mountain gets taller, it gets more massive. As it gets more massive, the pressure on the rock at its base increases. Eventually, this pressure would exceed the breaking strength of the rock.



What affects the altitude of a mountain ?

In fact, the factors that determine the altitude of a mountain are:

- Surface gravity
- Mass of the celestial body

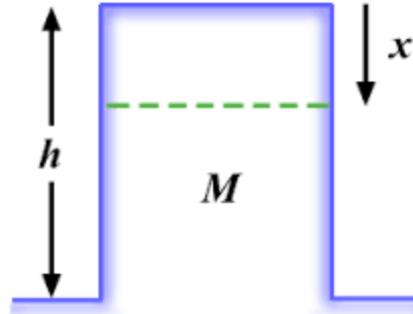
- Material of the rock
- Density of rock
- Breaking strength

What affects the altitude of a mountain ?

That pressure could be written

$$P = \rho g h$$

Where P is the pressure on the base, ρ is the density of the rock, g is the surface gravity of the planet, and h is the height of the mountain.



What affects the altitude of a mountain ?

If P is the breaking strength of the rock:

$$P = \rho g h \quad \longrightarrow \quad h g = P/\rho$$

Since P/ρ is just a constant, this relation tells us that the higher the surface gravity, the lower the maximum altitude that the mountain can support.

This also tells us $h g$ must also be equal to a constant, which lets us relate the maximum height of mountains on planets of similar compositions but with different masses:

$$h_1 g_1 = h_2 g_2$$

For example:

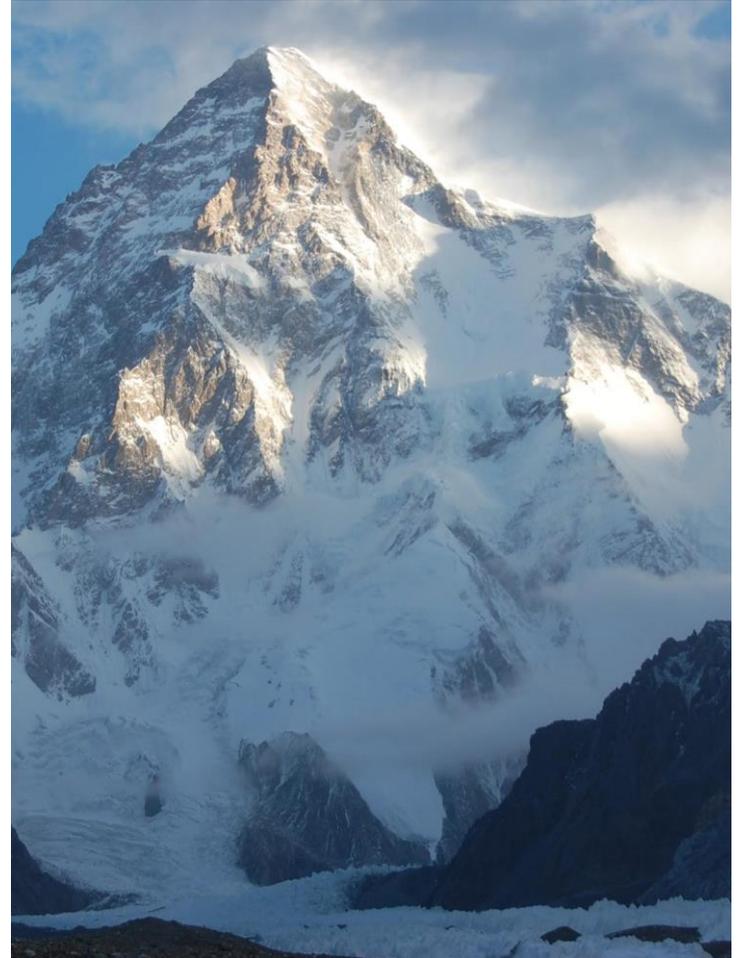
If you take Mt Everest to be the tallest mountain that can be supported on earth, and if you know that Mars surface gravity is 2/5th of earth surface gravity, you can actually calculate the height of Olympus Mons, which is the tallest mountain in the solar system. If you write:

$$h_{\text{everest}} g_{\text{earth}} / g_{\text{mars}} = h_{\text{olympus mons}}$$

$$5/2 h_{\text{everest}} = h_{\text{olympus mons}}$$

Conclusion

Mountains on smaller celestial bodies (asteroids, moons, dwarf planets e.t.c) with enough dense rock structure are more likely to reach higher altitudes than mountains on big planets with powerful gravitational forces. By using mathematical relations we can predict the current and/or the maximum altitude of the mountain.



Sources

En.wikipedia.org. (2019). *Mountain*. [online] Available at: <https://en.wikipedia.org/wiki/Mountain#Definition> [Accessed 8 Jun. 2019].

Reddit.com. (2019). *What is the highest a mountain can be? Is there a limit to it? : askscience*. [online] Available at: https://www.reddit.com/r/askscience/comments/57g0md/what_is_the_highest_a_mountain_can_be_is_there_a/ [Accessed 14 May 2019].

ThoughtCo. (2019). *What's the Difference Between a Hill and a Mountain?*. [online] Available at: <https://www.thoughtco.com/difference-between-hill-and-mountain-4071583> [Accessed 8 Jun. 2019].

Merriam-webster.com. (2019). *Definition of MOUNTAIN*. [online] Available at: <https://www.merriam-webster.com/dictionary/mountain> [Accessed 8 Jun. 2019].

An aerial photograph of a vast, rugged mountain range under a clear blue sky. The terrain is characterized by deep, winding valleys and sharp ridges, with some areas appearing to be covered in snow or light-colored rock. The lighting creates strong shadows, emphasizing the three-dimensional structure of the landscape. The text 'THANK YOU FOR YOUR ATTENTION' is centered in the upper half of the image in a large, white, sans-serif font.

**THANK YOU FOR
YOUR ATTENTION**