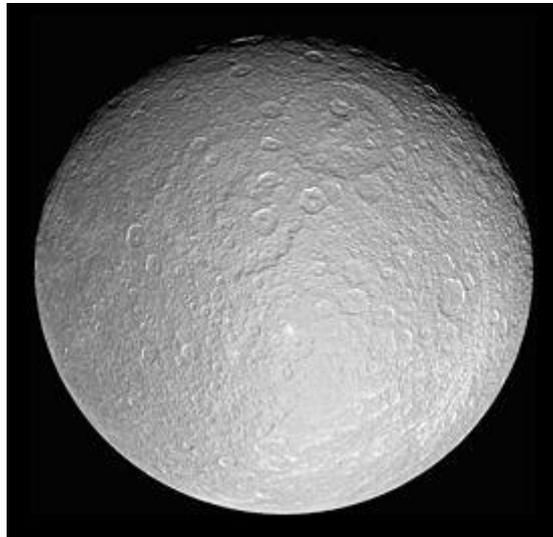


What has Saturn and a flightless bird that is a resident of the South American Pampas have in common? If you do or do not know the answer, continue reading about Rhea, one of Saturn's Moons. I will provide the answer at the end of this article.

In Greek mythology, the Titaness daughter of the earth goddess, Gaia and the sky god Uranus was Rhea, which is the name given to Saturn's second largest moon, the subject for this month.

Rhea was discovered by Giovanni Cassini on December 23<sup>rd</sup> 1652. At its discovery, Cassini referred to Rhea as one of four Sidera Lodoicea (star of Louis) after King Louis XIV. The other three were also moons discovered by Cassini and were Tethys, Dione and Iapetus, all of which will hopefully be covered in future articles. Rhea was also referred to as Saturn V, denoting the fifth moon in distance from Saturn itself.

Although Rhea is the second largest moon of Saturn, its diameter is a mere 949 miles, which is less than a third of Titan, Saturn's largest moon. It is a small cold airless body and is tidally locked to Saturn, which means, as our own Moon, the same side faces the parent planet at all times.

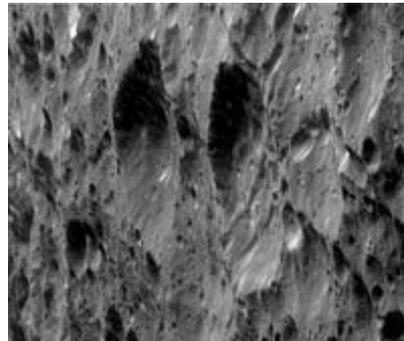


**Fig 1 Rhea**

The surface temperature of this icy body is  $-174^{\circ}\text{C}$  on the sunlit side and down to a very cold  $-220^{\circ}\text{C}$  in shaded areas. As can be seen above it has high reflectivity, which would indicate that it probably is composed of water ice. The Cassini probe, which is currently studying Saturn and its moons, has determined that Rhea has a density of 1.233 times that of liquid water, which suggests that it probably comprises three quarters ice and one quarter rock. There is evidence of Oxygen and carbon dioxide on Rhea in its tenuous atmosphere in proportion of 5 to 2. It is believed that the Oxygen could be the result of radiolysis (a process of dissociation of molecules by nuclear radiation) of water ice at the surface by ions supplied by the magnetosphere of Saturn, however the source of the carbon dioxide is less clear at this time.

This moon is more heavily cratered than other moons that are closer in orbit to Saturn. Rhea orbits Saturn at a distance of 327,490 miles, and at this distance the tidal effects of Saturn are less effective. The theory is that moons closer to Saturn are internally heated by the orbit around Saturn and as such, have smoother plains because liquid water is pushed to the surface, which very quickly freezes and covers up any craters on the surface. This effect has not been noticed on Rhea resulting in the heavy craters that are visible, despite being an icy body. If you would like to see the rotating surface of Rhea please look at <http://solarviews.com/raw/vss/VSS00163-640x480.mp4>,

Before the Voyager probes 1 & 2 in were sent up by NASA in 1980 and 1981, Rhea appeared as a tiny dot to astronomers. The Voyager probes determined that Rhea's craters were of two types, one with widths larger that 25miles across and the others less wide. This difference indicates that there must have been a major resurfacing event in Rhea's history in the distant past. It is the distant past because presently, there are very few young craters with rays extending away from them, as can be seen on our own moon. It is estimated that the plains on Rhea could be about four billion years old.



**Fig 2 Rhea's Surface craters.**

The Voyager images also showed mysterious wispy lines stretching for tens to hundreds of miles, which often cut through plains and craters. The Cassini probe images suggest that these could be subsidence fractures which results in canyons of great heights. The canyon walls appear bright because the darker material falls off them and exposes fresh bright water ice. Rhea may have been tectonically active in the past which could have produced these fractures.



**Fig 3: Image of Rhea from Voyager 2 with wispy lines**

Rhea orbits Saturn once every 5.516 Earth days. That makes its speed around Saturn an incredible 19,088miles/hour. That's one large snowball going around a big gaseous giant at quite a pace.

Rhea is the ninth largest moon in our Solar System and is the smallest body within the Solar System that is confirmed to be in hydrostatic equilibrium. Now I do not intend to go into the mathematics of hydrostatic equilibrium as that could confuse us all in one go. Suffice it to say, that a body is in hydrostatic equilibrium if the force of gravity equals and is opposite the pressure forces emanating from within the body. I assume that the Earth is in hydrostatic equilibrium; otherwise we will all be floating away into outer space or will be pushed further into the earth or water, depending upon whether gravity or internal earth pressure wins!!



**Fig 4 Comparison of Earth, Moon & Rhea.**

The above picture shows that the icy body Rhea is not quite the size of our moon, but would present a much shinier view if it were to orbit the Earth.

The moons of Saturn are thought to have been formed by a process similar to planetary formation in the Solar System. As the young gas giants such as Saturn were formed, they were surrounded by discs of material which coalesced into moons. There is however another theory which suggests that Titan was probably formed by giant impacts with pre-existing bodies or moons. If that theory is correct then the formation of Rhea will have to be re-considered.

Now did you know the answer to my first question? Here is the answer. Rhea is also the name of a flightless bird which is related to the Ostrich and is a native of the Pampas



**Fig 5 Rhea the Bird.**

On Rhea the Moon, Rhea the bird will be a ready frozen large Christmas Dinner.

From Jay Nair.