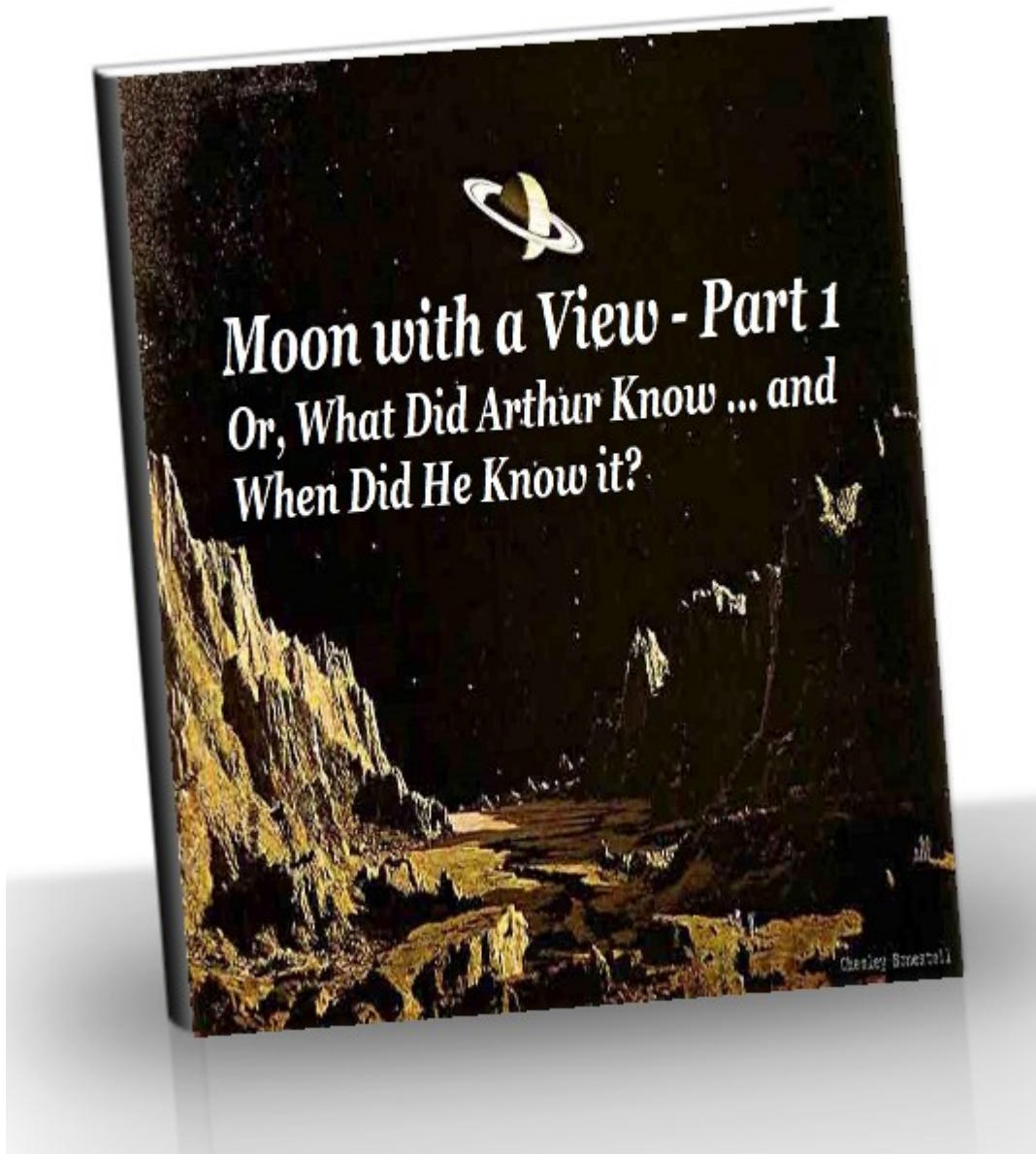


Moon with a View - Part 1



***Or, What Did Arthur Know
... and When Did He Know it?***

By Richard C. Hoagland
© 2005 The Enterprise
Mission

"The only way of discovering the limits of the possible is to venture a little way past them ... into the impossible."

-- Clarke's Second Law

... the ship had long since passed the boundary set by outermost Phoebe, moving backward in a wildly eccentric orbit eight million miles from its primary. Ahead of it now lay Iapetus, Hyperion, Titan, Rhea, Dione, Tethys, Enceladus, Mimas, Janus – and the rings themselves. All the satellites showed a maze of surface detail ... Titan alone – three thousand miles in diameter, and as large as Mercury – would occupy ... months ...

There was more; already he was certain that Iapetus was his goal.

... One hemisphere of the satellite, which, like its companions, turned the same face always toward Saturn, was extremely dark, and showed very little surface detail. In complete contrast, the other was dominated by a brilliant white oval, about four hundred miles long and two hundred wide. At the moment, only part of this striking formation was in daylight, but the reason for Iapetus's extraordinary variations in brilliance was now quite obvious



Those words -- written over forty years ago by my long-time friend, Arthur C. Clarke -- describe the voyage of a lone, surviving astronaut – David Bowman – to the ringed wonder of the solar system, the planet Saturn, aboard a 21st Century spacecraft named “Discovery.”

What Bowman discovers in the Saturn system – on an enigmatic moon called “Iapetus” -- will forever change the Destiny of Humans

But, Arthur’s prophetic words could just as easily be describing the current, equally astonishing 21st Century revelations of an unmanned spacecraft called “Cassini,” exploring the latest baffling mysteries Saturn In particular -- NOT the much ballyhooed, though recently successful descent of Cassini’s Huygens probe to the surface of Titan ... Saturn’s largest satellite (whose results will be involved later in our extraordinary tale ...)—



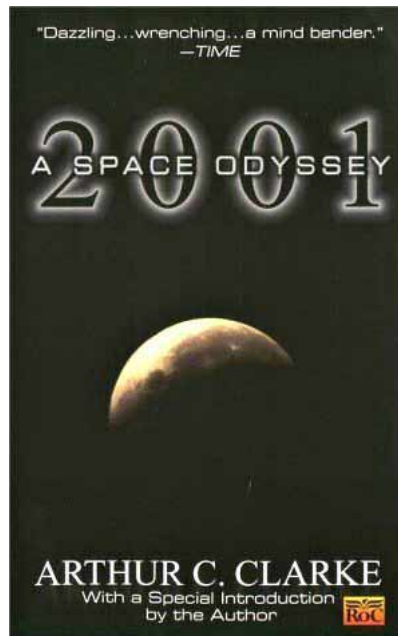
But Cassini’s far lesser known, far more haunting ... (and to me) far more significant—

Close-ups of Iapetus!

In 1965, when Arthur began collaborating with the brilliant film director, Stanley Kubrick, it was to bring their unique view of Mankind’s most enduring mystery – “Where do we really come from ...?” – to the silver screen, in a way never seen before. They succeeded ... brilliantly.

The result was the immortal “2001: A Space Odyssey.”

Simultaneously, Arthur penned the “Saturn approach” scene we began with (above), his own independent version of the same story -- a novel – which, to some at least, has made portions of Stanley’s very enigmatic “2001” perhaps a little more accessible (at least, certain “transcendental” aspects of the film ...).



In Kubrick’s extravaganza, the climax comes when David Bowman -- the lone surviving astronaut of the deep space expedition, sent by a future “NASA” in search of the Force which, “godlike,” has somehow repeatedly intervened in “the million plus year evolution of Mankind ...” – finally encounters the “Monolith” ... a black enigmatic “door,” in orbit around the giant planet Jupiter.

The Monolith turns out to be (among its other wonders) a “star gate” – a literal doorway (which, of course, is why Kubrick cinematically made it a door ...) to other dimensions of space and time ... and, ultimately, the mysterious “Progenitors” of the Human Race itself.

When Bowman eventually falls through it, he enters the Star Gate’s vast Hyperdimensional transport system, culminating in his own ambiguous meeting with “the Progenitors” (or, at least as much of them as they allow

him to experience ...), which results in his final “transformation” and return to Earth ... the latest agent in Humanities continuing “managed evolution.”

In Arthur’s novel (removed from the pre-CGI, 1960’s limitations on film “special effects” that even Stanley Kubrick had to live with ...), the Monolith is waiting much farther from the Sun ... on one of Saturn’s distant moons—



The same moon -- forty years after Arthur’s novel – I would contend, which has now been revealed in Cassini’s latest images as—

***THE MOST BAFFLING ... BUT
ARGUABLY, THE SINGLE MOST
IMPORTANT OBJECT IN THE
SOLAR SYSTEM***

Iapetus [eye-AP-i-tus] is the seventeenth of Saturn's thirty three currently known moons, and the third largest. It was named after a Titan -- the son of Uranus and the father of Prometheus and Atlas (the latter said to be the

“fathers of Mankind”). Thus, in Greek myth, Iapetus was also an ancestor ... a progenitor... of “Homo Sapiens Sapiens”

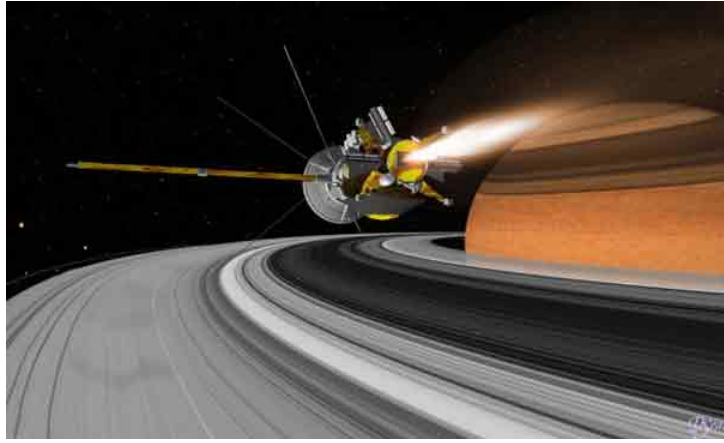
Iapetus was first seen via telescope by Jean-Dominique Cassini, in 1671.



Iapetus’ actual name, however, was only given to it a hundred and seventy six years after it was first seen by Cassini (who merely referred to it, and the other three star-like objects he also discovered circling Saturn, as “Lodicea Sidera” --“the stars of Louis” -- in honor of France’s King Louis XIV, who had appointed him France’s “chief astronomer”).

The current names of Saturn’s major moons, taken from a group of “superbeings” in Greek myth called “Titans,” were given them by Sir John Herschel, in 1847. Herschel’s nomenclature for Iapetus and the other six (then) known moons, was based on the logical association of Saturn (“Cronus” in Greek) with the Titans; Herschel, continuing the ritual, named the largest Saturnian moon “Titan” itself – in honor of the entire pantheon.

Speaking of names: Cassini would go on to eventually discover the largest “gap” in Saturn’s splendid, bewilderingly complex rings, five years after discovering Iapetus ... in 1676. This was later appropriately named after its own discoverer – the “Cassini Division” (below, under spacecraft). It is, of course, because of Cassini’s record of several major astronomical discoveries at Saturn, that the current unmanned Saturn mission is so-named



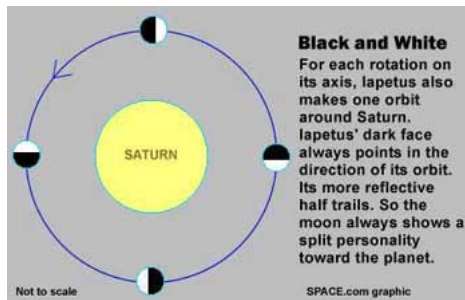
Iapetus' most singular characteristic is the fact that, in Cassini's small, 17th century refracting telescope (it only had an objective lens two inches in diameter!), the faint Saturnian moon (about 100 times dimmer than the faintest object visible to the unaided naked eye) seemed to literally disappear about every 40 days ... for half its 79-day orbit!

As Cassini watched, Iapetus would be visible during its so-called "western elongation" (when it was west of Saturn in the sky), but would then progressively get dimmer as it curved around and passed behind the planet, until it completely vanished as it approached "eastern elongation." Then, a few days later, it would "magically" reappear ... as an extremely faint "star" ... growing steadily in brightness, until it reached its farthest distance west of Saturn once again and its greatest brightness!

This puzzling behavior would then mysteriously repeat -- like the newly invented mechanical clockwork -- every 79 days; a mysterious "winking" moon ... orbiting Saturn ... for as long as Cassini observed.

Although he was only capable of observing Iapetus in his small telescope as a "dimensionless point of light," Cassini correctly theorized that this "winking moon" phenomenon had to be due to the fact that one entire hemisphere of Iapetus must be vastly brighter than the other half – and that the moon was synchronously rotating (with one hemisphere continuously facing Saturn – like Earth's Moon always faces Earth) as Iapetus revolved around the distant ringed planet in its 79-day orbit (below). If the leading

hemisphere of Iapetus was “very dark” Cassini theorized, and the trailing hemisphere “remarkably bright,” this simple geometry would result in the distant moon periodically falling below detectability in his “modest glass ...”



Three hundred ten years later – on November 14, 1980 -- the NASA Voyager 1 unmanned spacecraft transmitted, from only a few hundred thousand miles away, the first clear image back to Earth showing that Cassini had been right! Remarkably, the entire “front half” of Iapetus was fully ten times darker than the “back half” – the former reflecting only about as much light as a piece of charcoal ... or (as Arthur put it in “2001”) burnt toast!

The geometry of this inexplicable dichotomy also proved unique (below): for obvious reasons, Iapetus forever earned the title that evening, after Voyager’s historic first fully resolved images were sent home, of—

“The Yin/Yang Moon”



... At last, the pale dawn lay ahead; the ship, moving more and more slowly now, was emerging into day. It could no

longer escape from the Sun, or even from Saturn – but it was still moving swiftly enough to rise away from the planet until it grazed the orbit of Iapetus, two million miles out.

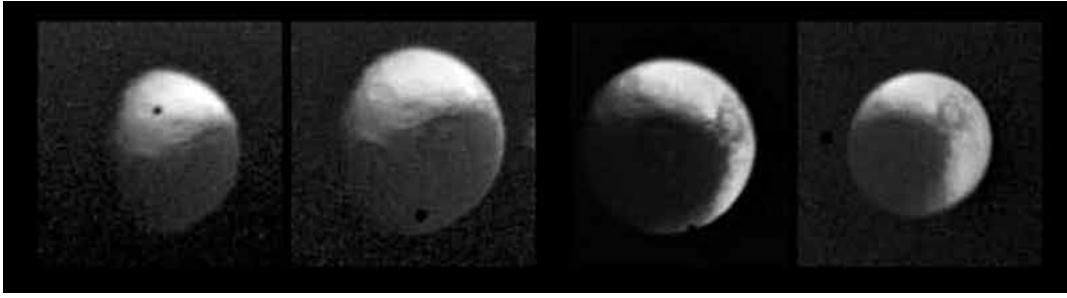
It would take Discovery fourteen days to make that climb, as she coasted once more, though in reverse order, across the paths of all the inner moons. One by one she would cut through the orbits of Janus, Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion ... worlds bearing the names of gods and goddesses who had vanished only yesterday, as time was counted here.

Then she would meet Iapetus, and must make her rendezvous

....



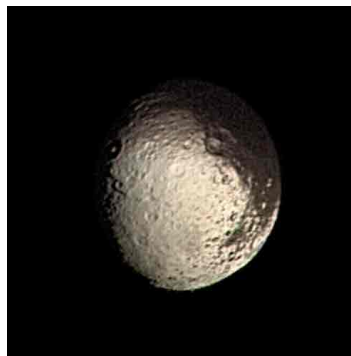
Voyager acquired many images as it approached Iapetus for the first time. On some of them (below - left), a large (~ 150 mile diameter), dark, ring-shaped feature appeared on the side of the moon facing Saturn. In the center of the ring -- almost exactly as Arthur had described it before anyone could have seen it -- was an “elliptical white region ... with a black center!”



Arthur later reported that our mutual friend and colleague, the late Carl Sagan -- who was one of the Voyager imaging team members -- some time after the first Iapetus encounter, sent him one of these remarkable photos (above) ... along with a note:

“Thinking of you”

In these first fascinating images, tangent to this giant ring (above) -- in fact, appearing to emanate from it in some kind of “directed spray pattern!” -- was the far larger, extremely dark, elliptical feature which appeared to cover the entire “front” of this exotic moon. This was strikingly confirmed by a somewhat closer shot, taken in approximate natural color by the follow-on Voyager 2 spacecraft (and, of the opposite side of the moon -- the one facing away from Saturn) ... in August, 1981 (below).

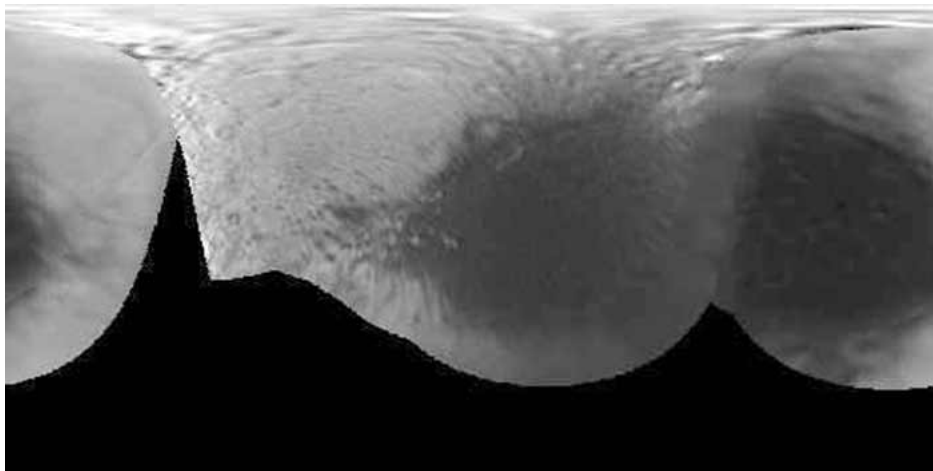


Another, closer shot -- this time, of the Saturn side of Iapetus again, from the current Cassini mission (below). Imaged by Cassini’s much superior solid-state cameras, in July, 2004, the view confirms Voyager’s remarkable first impressions



Mercator projection maps (below), created from images secured during both Voyager fly-bys (the black regions are areas not covered by either spacecraft), confirm this remarkable geometric aspect of “the dark side of Iapetus”: the extraordinarily dark region traces an almost exact elliptical pattern on the “front” of this increasingly bizarre moon

But the cause of this unique, geometric “two-toned” surface was still as mysterious after the two historic Voyager encounters ... as before.

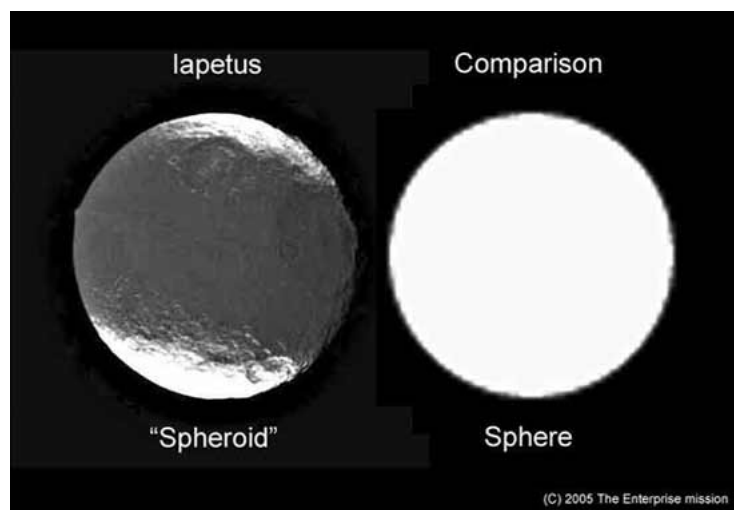


Thus, it was with some anticipation that those of us who were lucky enough to be at JPL the night of the first Voyager Iapetus images twenty five years ago, looked forward a few weeks ago to the closest fly-by of Iapetus to date – to be accomplished by the Cassini spacecraft, on New Year’s Eve, 2004.

Passing as close at 40,000 miles, and with cameras orders of magnitude superior to Voyagers', the results of the December 31, 2004 Cassini imaging did not disappoint: not only do the details surpass all prior expectations ... they reveal even deeper mysteries surrounding this increasingly exotic moon

The distant images immediately confirmed one curious impression left from the Voyager encounters of a quarter century before: in addition to its other unique characteristics, Iapetus does not seem to be a perfectly round moon!

A comparison with a real sphere (below-right) reveals that, from this angle, Iapetus is visibly "squashed" -- by something like 50 miles out of its 900, or about 5%. For solid rocky bodies larger than a few hundred miles across, the relentless force of gravity always overcomes the innate tensile strength of such materials, and forces them to assume a spherical geometry. For solid icy bodies (those possessing less tensile strength), the limiting size before a sphere is formed is even smaller.



The key to defining this upper "roundness" limit lies in remotely determining a moon's "specific gravity," which will in turn reveal its average composition.

The means of doing this via an orbiting or passing spacecraft, is by optically measuring the object's diameter (from images), then comparing that to its overall mass (derived from observing the effect of its gravitational field on the spacecraft's trajectory). This mass determination, divided into the optical diameter, then gives the average density of the object – which, in turn, can narrow down its potential composition.

Earth's Moon, for example, has an average density of "3.34" (3.34 times a similar-sized sphere composed of water) – revealing it to be composed primarily of much denser "silicates" ... a rocky object. Thus, at 2160 miles across, despite the significant tensile strength of "rocks," the Moon's own gravity has crushed it down to almost a perfect sphere, as seen from Earth.


For Iapetus, Voyager's measured density (via the techniques described above) is about 1.21 – clearly only slightly denser than an equal sized body made of water (there were obviously a few rocky "impurities" incorporated into Iapetus during its formation, slightly increasing its average density ...). Because this solid, mostly icy body measures almost 900 miles across, yet rotates only once every 79 days, any equatorial "centrifugal force" is clearly insignificant. Thus, this cannot be the source of Iapetus' major "out of roundness."

Coupled with the density observations of Voyager (and now Cassini), these simple calculations assure that Iapetus' basic shape (not counting pieces blown off by external comet impacts ...) should be essentially a perfect sphere. Several of Saturn's significantly smaller moons -- like Mimas and Enceladus -- although also icy objects, are spheres

Clearly, for some important reason Iapetus is not.

Now, look again at the left-hand image of Iapetus (above). What's that "thing" ... sticking up twelve miles above the left-hand limb? According to NASA's official description of this image, it reveals in 3-D--

... a long narrow ridge that lies almost exactly on the equator of Iapetus



Cassini-Huygens
MISSION TO SATURN & TITAN

For News Media ↗

- Introduction
- News Releases
- Significant Events
- Features
- Mailing List Sign-up
- Fact Sheets
- Press Kits
- Contact Us

For Planetariums & More ↗

For Educators ↗

For Kids ↗

HOME

OVERVIEW

MULTIMEDIA

CASSINI AT SATURN

MISSION

SPACECRAFT


SCIENCE

NEWS - News Releases - 2005

Saturn's Moon Iapetus Shows a Bulging Waistline
January 7, 2005
(Source: Jet Propulsion Laboratory)

Images returned by NASA's Cassini spacecraft cameras during a New Year's Eve flyby of Saturn's moon Iapetus (eye-APP-eh-tuss) show startling surface features that are fueling heated scientific discussions about their origin.

One of these features is a long narrow ridge that lies almost exactly on the equator of Iapetus, bisects its entire dark hemisphere and reaches 20 kilometers high (12 miles). It extends over 1,300 kilometers (808 miles) from side to side, along its midsection. No other moon in the solar system has such a striking geological feature. In places, the ridge is comprised of mountains. In height, they rival Olympus Mons on Mars, approximately three times the height of Mt. Everest, which is surprising for such a small body as Iapetus. Mars is nearly five times the size of Iapetus.



Iapetus in 3D

[More Iapetus Images](#)

Images from the flyby are available at <http://saturn.jpl.nasa.gov>.

The release then goes on to say, with serious understatement:

... no other moon in the solar system has such a striking geological feature

On color versions of the same image (below) -- created by compositing three Cassini views taken through ultraviolet, green and infrared filters -- the contrast between the bizarre “chocolate brown” of the leading hemisphere, and the brilliant white “polar caps” north and south -- is particularly striking.

As is the presence of that baffling, arrow-straight, 12-mile-high (~60,000 foot!) “wall” -- which precisely bisects the leading hemisphere, and apparently crosses the entire width of this strangely darkened “Cassini Regio” ... over 800 miles in length.



... for weeks, as it stared forever Sunward with its strange senses, the Star Gate had watched the approaching ship. Its makers had prepared it for many things, and this was one of them. It recognized what was climbing up toward it from the warm heart of the Solar System.

If it had been alive, it would have felt excitement, but such an emotion was wholly beyond its powers. Even if the ship had passed it by, it would not have known the slightest trace of disappointment. It had waited three million years; it was prepared to wait for eternity

There has hardly been an observer, viewing these astonishing new Cassini images of Saturn's strangest moon, who has not also thought of Arthur Clarke ... and "2001."

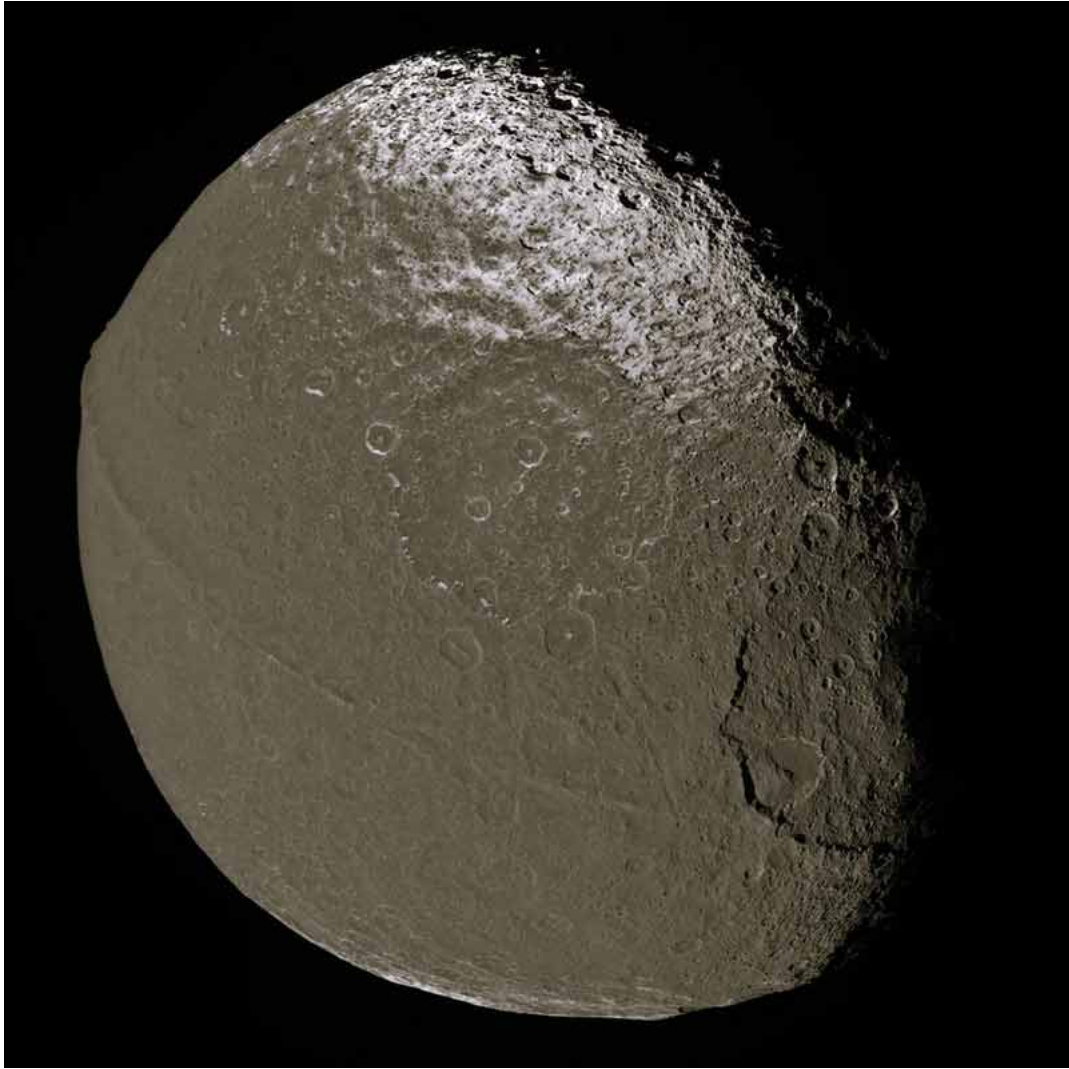
But some, after seeing the staggering equatorial feature now girdling Iapetus, reached back even further into Arthur's past, to recall an earlier, equally prescient short story, called eerily—

"The Wall of Darkness."

... In a universe consisting of one star and one planet, here is a mysterious impenetrable wall surrounding the entire planet in the deep freezing southlands. Two men, one with money, the other with building skills, engage in a long-term program to scale the wall and find out what's on the other side. The answer turns out to be ... rather upsetting

In our opinion, Cassini's discovery of "the Great Wall of Iapetus" now forces serious reconsideration of a range of staggering possibilities ... that some will most certainly find ... upsetting:

That, it could really be a "wall" ... a vast, planet spanning, artificial construct!!



This is not the first time that startling new data has prompted scientific consideration of “intelligence” at Saturn.

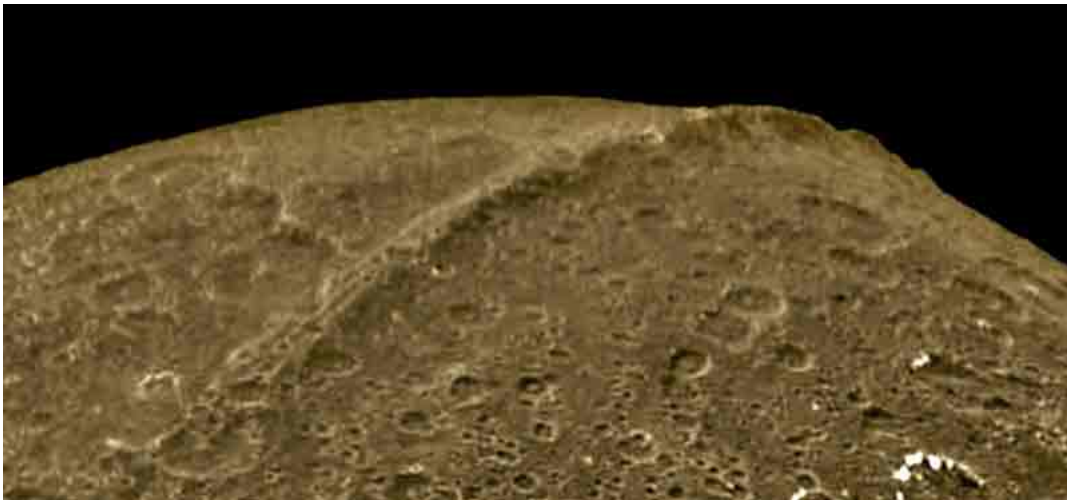
In addition to Arthur’s well-known musings, the extreme albedo range displayed by Iapetus prompted a sober suggestion in the 1980’s, that “the brightness variations might be artificial.” Donald Goldsmith and Tobias Owen (the latter, the NASA discoverer of “the face on Mars!”) wrote of Iapetus in The Search for Life in the Universe (1980):

This unusual moon is the only object in the Solar System which we might seriously regard as an alien signpost - a natural object deliberately

modified by an advanced civilization to attract our attention [emphasis added]

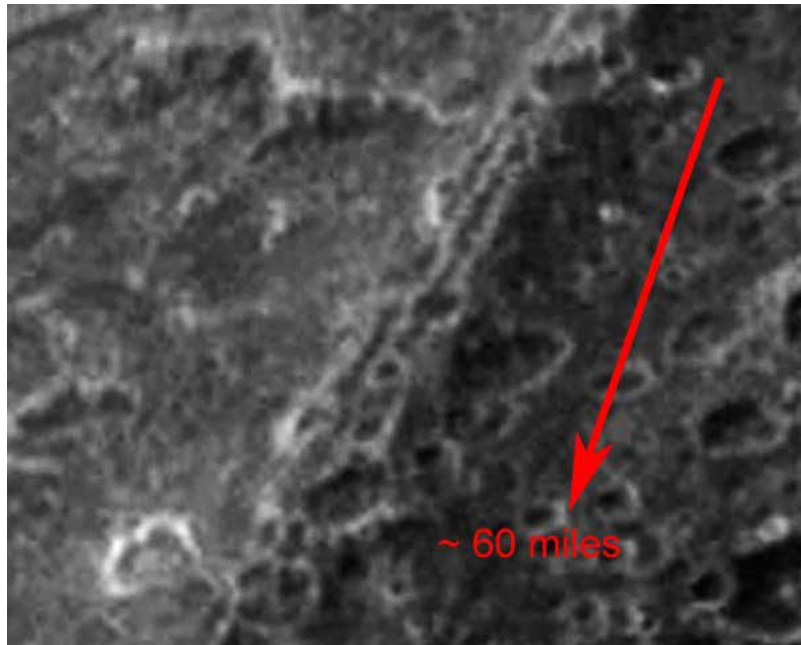
However, now that Cassini has revealed to us unquestionably the greatest linear feature in the solar system (below), such scientific speculations take on added urgency – if, for no other reason -- because—

There is no viable geological model to explain a sixty thousand-foot-high, sixty thousand-foot-wide, four million-foot-long “wall” ... spanning an entire planetary hemisphere ... let alone, located in the precise plane of its equator!



It is a well-known cliché that “Nature doesn’t usually create straight lines.” If that is true, then it certainly doesn’t create three of them (close-up-below) – all running parallel, not only to each other, but to the literal equator of the planet.

“Nature” also doesn’t create a veritable “Maginot Line” of the geometric complexity and regularity seen here ... certainly not one stretching horizontally, across this one small section of Iapetus, for over sixty miles



Therefore, ignoring for the moment “who” might have constructed such an astounding edifice, and for “what reason,” the most important question at this stage is simply:

“Is it feasible? Could a literal wall -- 12 miles high ... and 12 miles wide -- be technologically constructed on Iapetus?!”

The short answer is: yes.

The largest skyscraper currently planned for Earth is soon to be completed in the oil-rich kingdom of Dubai. The massive structure (below), assembled with conventional concrete and steel but in a “buttressed core configuration,” will reach an unprecedented height of 2312 feet when completed, projected for sometime in 2008!



Scaled according to the surface gravity of Iapetus – which is only 1/40th the strength of the surface gravity of Earth! – a similar skyscraper on the 900-mile-wide moon of Saturn could reach up 15 miles.

A “wall-like” structure -- as wide as it is tall – because of strong lateral support, could reach far higher in such a weak gravity field.

So, even with “conventional” building materials common in the early 21st Century on Earth, constructing the “Great Wall of Iapetus” poses no significant theoretical problems (except for the money, of course!). And, for any advanced “extraterrestrial materials” (nanotubes, carbon fibers, zero-gravity crystalline titanium and steel, etc. ...) the practical problems in constructing even such a structure as the “Great Wall” ... would be trivial. Especially--

If armies of computer-controlled, robotic construction “workers” (or even more advanced versions, billions of nanobots) were involved

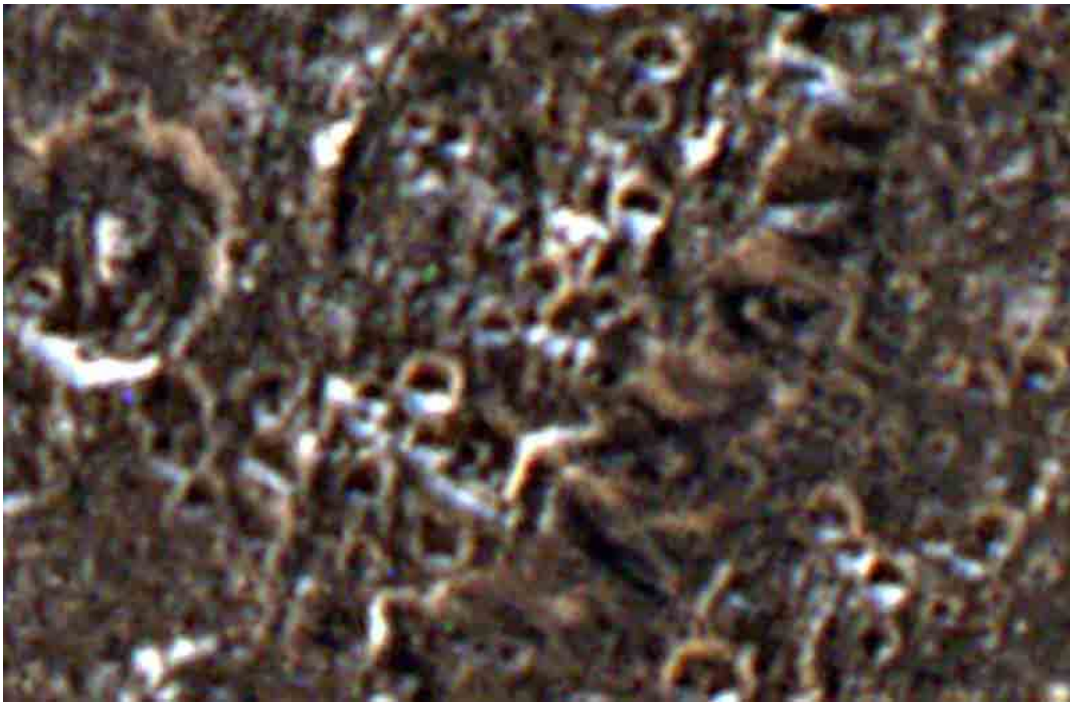
Once this shocking idea (and the even more astounding Cassini evidence ...) has been properly assimilated – that this extraordinary feature on Iapetus could be a manufactured artifact -- other, equally geometric, non-natural anomalies begin to emerge across the moon's exotic two-toned surface (inset, below)!



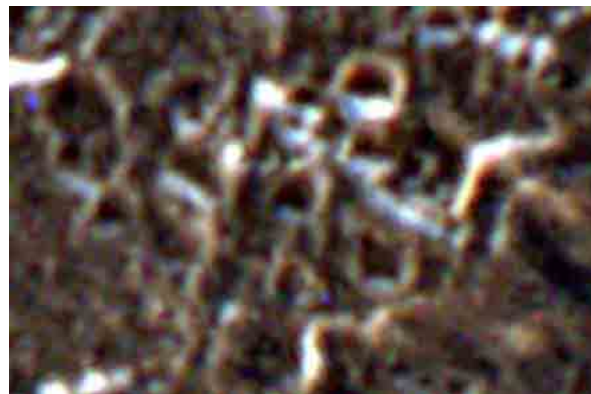
In this inset (below) is a striking set of clearly defined, astonishing, repeating, three-dimensional rectilinear surface patterns -- imaged in color and located several hundred miles north of the Wall ... near the boundary between the “brown stuff” and the “white stuff” on the leading hemisphere of Iapetus (sunlight from bottom left).

The rectilinearities run precisely north/south, east/west

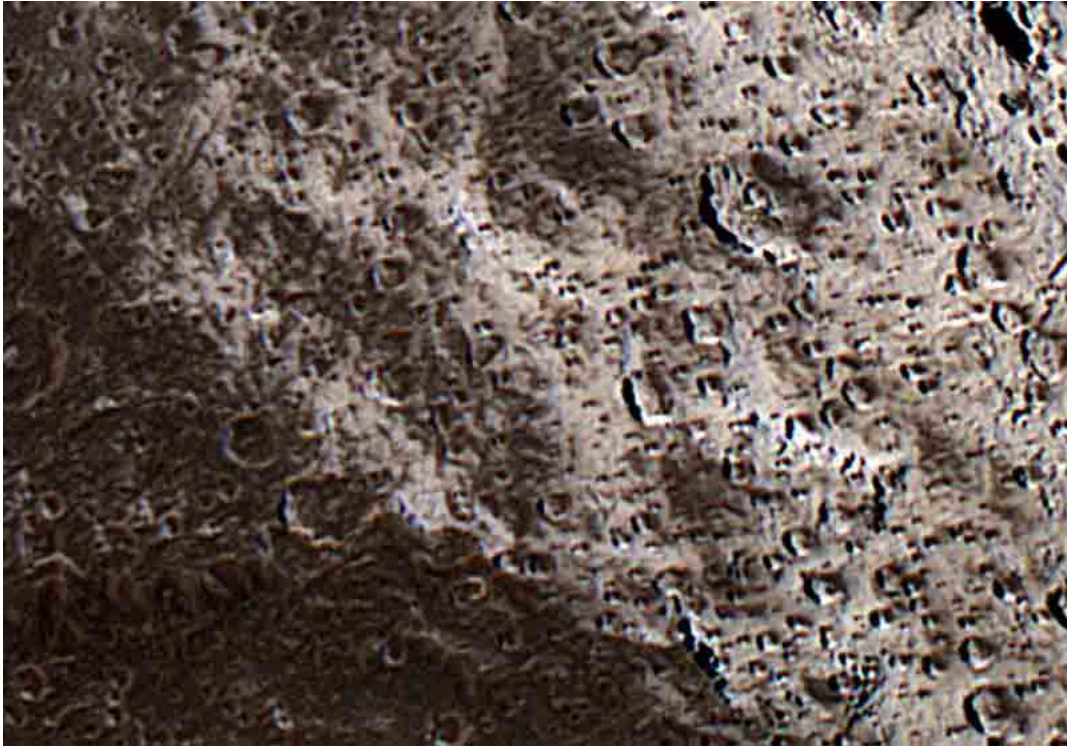
Clearly these are NOT random, “square craters” -- but remarkable, highly ordered evidence of sophisticated, aligned, repeating architectural relief!



A close-up (below) amply confirms this first impression. Note the “standard-width,” right-angle walls, and the dozens of “box-like” rooms and buildings contained within those walls



Close-ups from other sections of this “transitional terrain” (just west of this image - below) reveal more of this astonishing, three-D “honeycombing.” Note the aligned edges of the hundreds of “square” holes in this image ... and, again, more repeating, right-angle, uniform-width “walls.” Here, the repeating, rectilinear geometry appears to be “mantled” with a heavy “snowfall”

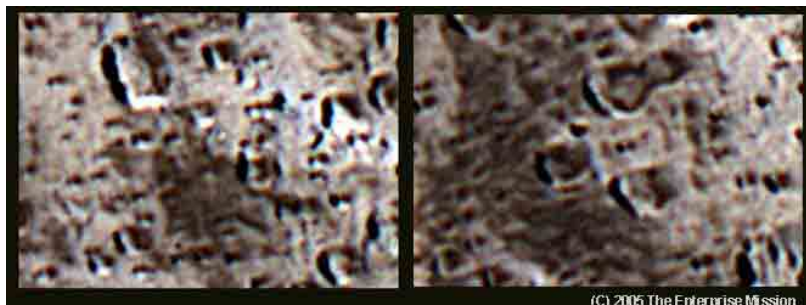


Here (below), are two close-up sections of the previous image.

The enlargement on the left features a square opening, apparently looking deep below the surface ... into a rectangular underground tunnel with multiple, geometric “levels.”

The close-up on the right shows an equally obvious, multi-storied, rectangular structure -- flanked on three 90-degree sides by concave “stadium-like” features ... with a, roofless, lattice-like “building” on the right of the central rectangle.

Smaller, equally geometric and carefully aligned “box-like openings” appear farther away

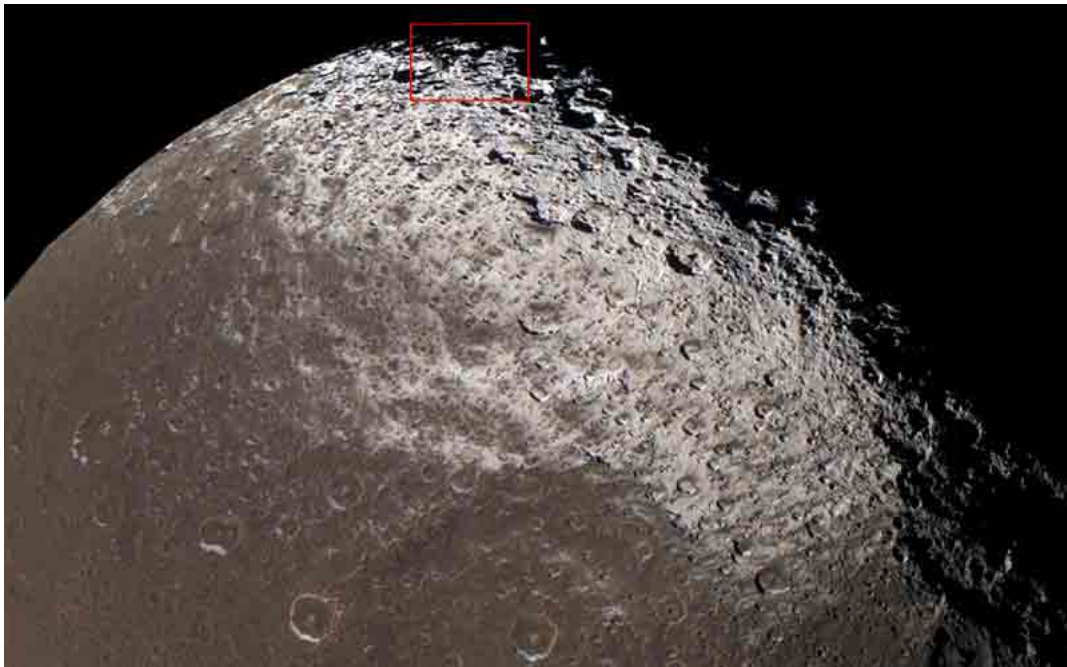


The impression of a vast set of extremely ancient ruins – most now without roofs, but with ample surviving walls – covered both by “snow” ... and whatever the “brown stuff” is ... is unavoidable.

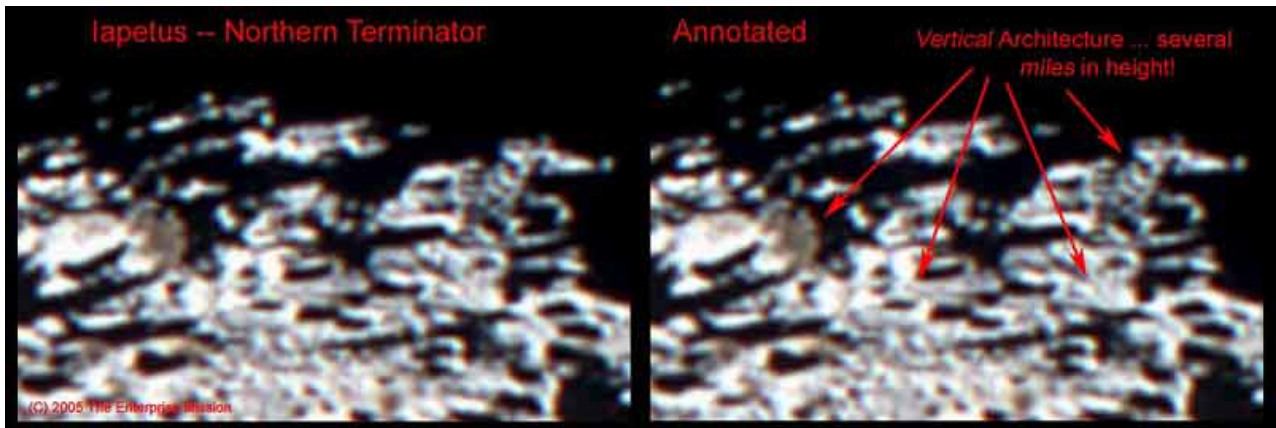
If the idea of a massive, artificial “wall” girdling this satellite is difficult to swallow, the existence of thousands of square miles of clearly rectilinear ruins on the same airless, icy satellite is definitely “over the top.”

So, let’s examine some more evidence

Here (below) is a wide angle Cassini color image, taken of the northern “polar ice” and terminator. At top center (red outline) is an area where the spacecraft is looking almost horizontal to the local surface.



In close-up (below), the intensely angular -- and repetitive -- vertical architectural geometry, and rectilinear design extending across this entire region, is unmistakable ... and totally “unnatural.”



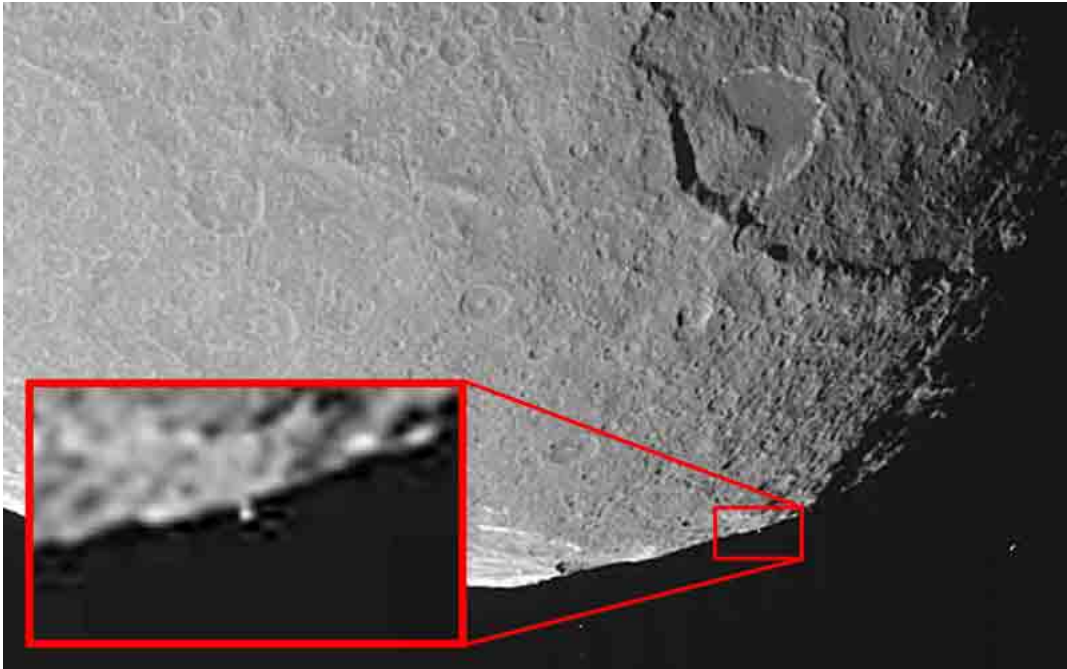
Confirmation that “something” (besides the astonishing equatorial “wall”) is extending miles into space – here, above the polar regions of this 900-mile-wide moon (below) -- can be seen in this equatorial low-res approach color image -- taken by Cassini at approximately 500,000 miles, on December 26, 2004.



Note (close-up, below) the string of bright, reflecting objects -- hanging (somehow ...) well above the satellite’s limb



Then, if we look along the southern horizon, we see the same type of anomaly ... this time a “tower-like structure,” rising more than a mile above the surrounding terrain (below)



Above it lies a remarkably geometric “waffle pattern” – more evidence that all on Iapetus is not quite “natural.”

All pointing toward an equally “unnatural,” if not extraordinary explanation for this “moon”

What the hell did Arthur know ... and “how?!”