

Planet Vasuki within the Inner Oort Cloud ended many ice ages

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Summary

In recent years, better measurements have proliferated the number of ice ages, which has caused ice-age theory to focus on celestial mechanics rather than orbital parameters of Earth to explain their cyclicity. Three fundamental questions remain:

A: What causes ice sheets to cycle?

B: What causes ice sheets to shrink?

C: What causes ice sheets to grow?

Two discoveries have led me to propose a new theory of ice ages.

The first discovery was two opposing planets that circled the Sun every 16 years. Hindu mythology mentions them, but then they disappeared. At the greatest extent of the last ice age, in the midst of a comet barrage, the Sun captured a planet from outer space. After capture, it passed a large planet named Mohini/Tiamat, which had a four-year orbit before being destroyed and leaving the asteroid belt. Mohini impaled the intrusive planet with a small moon that cleaved it into two pieces. Each piece reformed into a smaller, dark planet at least half the size of Moon and carried on with the same 16-year period. Around each planet was a cloud of satellites and debris left over from the split, like a comet tail. Jupiter gradually forced their orbits into the same plane as Earth's, after which satellites began to strike Earth every eight years. Sea level, which had been falling for 100,000 years, reversed and began to rise as ice sheets were ablated. Five thousand years later, both planets got too close to Jupiter, who kibbled them. The remnants

continued along in the same orbit, strung out in a chain, and now bombarded Earth every year with bigger pieces. As a result of this barrage, sea level rose dramatically, 5 cm a year, thus ending the ice age.

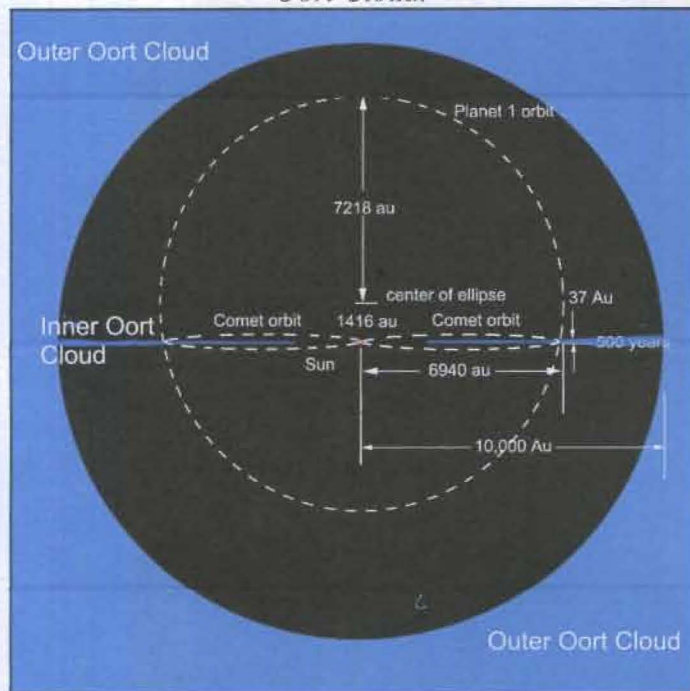
The second discovery was that each ice age ended with the same kind of comet barrage, which indirectly caused a rapid rise in sea level by allowing the Sun to capture a planet and Jupiter to kibble it. The terminus of every ice age can be modeled as two series with periods of 204,400 years and 137,000 years.

A clue to all three questions occurs in the Hindu creation myth, paraphrased as 'At a time when **Vasuki** stirred the celestial ocean and caused a barrage of comets and planets to intrude into the solar system for a millennium, ...'. *Vasuki* means 'Open-mouthed serpent', that is, the constellation Hydra; this comet barrage originated where Hydra crosses the celestial equator.

This repetition of sea-level rise may be explained by two large planets orbiting through the thin, flat disk of the Inner Oort Cloud (IOC) (Figure 1). Each passage disturbs a large number of comets and planetoids, half of which orbit the Sun while the rest vanish into the Outer Oort Cloud (OOC). Comets orbit three times for each orbit of the planet, and each round trip adds to the number of comets. It is not the comets themselves that cause sea level to rise, but capture of a planet by the Sun, then destruction of the same planet by Jupiter.

The only way for a long-period comet to slow down enough to be captured by the Sun is start off in a retrograde orbit in the planetary plane, then pass in front of a large planet like Jupiter, Neptune or Uranus.

Figure 1: Twice each revolution, Planet 1 disturbs comets and planetoids in the flat disk of the Inner Oort Cloud.



Based on Hindu mythology, each barrage lasted a thousand years, which might be twice the thickness of the IOC. Based on Monte Carlo simulation, the average comet from the OOC repeats this round trip 35 times before an interaction with a planet alters its orbit (Weigert & Tremaine, 1999). Comets from the IOC interact more frequently with large planets in the same plane, so an average comet might last 10 round trips.

Estimates of the IOC comet population above 100 m diameter range from 5 trillion to 13 trillion. During a comet barrage, 1 to 3 new comets circle the Sun every day; 3% of these would be planetoids, of which the Sun would capture one or more of planet size during each barrage.

For the last 800,000 years, sea level has continuously declined until encountering a comet barrage. It appears that we are in a perpetual ice age, relieved only by the outcome of a comet barrage. Sea level inferred from deep-sea cores suggests that this perpetual ice age and comet cycle began 2.5 million years ago. If so, something drastic happened, like a sudden tilting of the axis from 0 to 23 degrees.

What causes ice ages to cycle?

This paper proposes that ice-age cycles are determined by the end of an ice age. Each ice-age terminus follows a comet barrage. These comet barrages originate in the flat plane of the Inner Oort Cloud, stirred up by two outer planets that circle the Sun. Each of the outer planets has a period three times that of the comets they disturb, so that returning comets cluster together.

First let us examine the dimensions and character of the Oort Clouds.

Oort Clouds

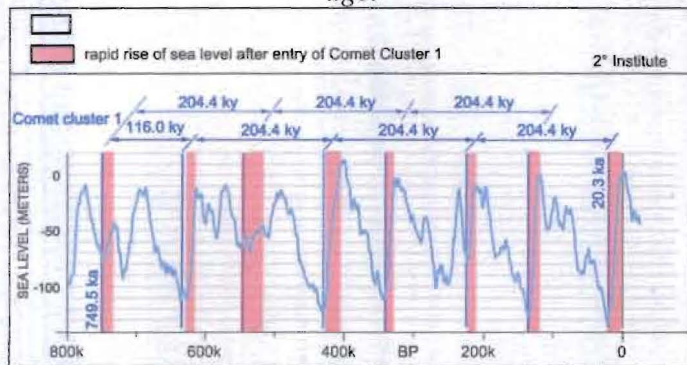
The Outer Oort Cloud (OOC) is a hollow, prolate spheroid with the long axis oriented toward the galactic nucleus, an inner radius of 10,000 au and an outer radius of 100,000 au (Figure 1). Within the OOC are 1-2 trillion comets larger than 100 m, spaced 15 au apart. They wander in all directions, but stay within the cloud until perturbed. The average distance of perturbed comets is 43,000 au from the Sun. The distribution of perturbed comets peaks at $\pm 25^\circ$ from the galactic latitude, and is deficient in the direction of the galactic equator and poles (Weissman, 1990).

The Inner Oort Cloud (IOC) bisects the OOC. It is a thin disk densely populated with comets. Its inner edge begins 2000 au from the Sun and ends 10,000 au from the Sun at the boundary of the OOC (Figure 1). Within this disk are 5 to 13 trillion icy comets plus 3% asteroids that range in diameter from 100 m to planet size. They circle randomly around the Sun until perturbed. Most perturbed comets eventually end up in the OOC (Weissman, 1990).

Planet 1

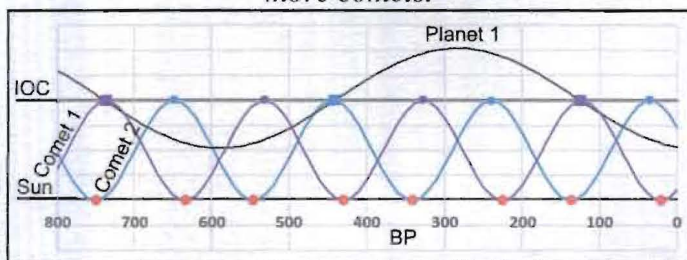
Eight ice ages in the last 800,000 years ended with a comet barrage having a cycle of 204,400 years (Figure 2).

Figure 2: Planet 1 created comet barrages with a period of 204,400 years; each barrage ended an ice age.



These comet barrages can be represented as two sine waves with an offset caused by the orbit of Planet 1 not being a perfect circle (Figure 3). The long offset is 116.0 years, the short offset is 88.4 years. At every third revolution, Planet 1 adds more comets to the returning comet cluster.

Figure 3: Elapsed time between comet barrages. Comets cycle between an orbit around the Sun and hitting the IOC. At every third orbit, Planet 1 adds more comets.



Comets disturbed by Planet 1:

The period of the comet determines its maximum distance from the Sun.

Let t_c = comet period = 204,400 years

Let a_c = comet semi-major axis

By Kepler's second law, $t^2 = a^3$:

$$a_c = t_c^{2/3} = (204,400)^{2/3} = 3470 \text{ au}$$

The long axis of the elliptical orbit is $2a_c$.

$$2a_c = 6940 \text{ au}$$

For Planet 1:

Let t_p = planet period

Let a_p = planet major semi-axis

Let the ratio between comet orbits to planet orbits be 3:1. The planetary period determines the semi major axis:

$$t_p = 3t_c = 3(204,400 \text{ yrs}) = 613,200 \text{ yrs}$$

$$a_p = t_p^{2/3} = (613,200)^{2/3} = 7218 \text{ au}$$

Assume Planet 1 intersects the IOC plane perpendicular to the major semi-axis at f_p , the focus of the Sun; this allows both comet clusters to have the same period. Otherwise, the ratio of 3:1 will work for one comet cluster but not the other.

The radial distance from f_p to r_p where it intersects the IOC is $2a_c$, the distance the comets travel. From this distance, calculate e_p , the eccentricity of Planet 1.

$$r_p = a_p (1 - e_p^2) = 6940 \text{ au}$$

Solving for e_p :

$$e_p = (1 - 6940 \text{ au} / 7218 \text{ au})^{0.5} = .19625$$

Then the focus distance f_p is:

$$f_p = a_p e_p = 7218 \text{ au} * 0.19625 = 1416.5 \text{ au}$$

and the minor semi-axis b_p is:

$$\begin{aligned} b_p &= a_p (1 - e_p^2)^{0.5} \\ &= 7218 \text{ au} (1 - 0.038515)^{0.5} \\ &= 7218 * .9805 = 7077.3 \text{ au} \end{aligned}$$

At this distance, Planet 1 travels in one orbit:

$$(7218/2 + 7077/2) * 2\pi = 44,909 \text{ au}$$

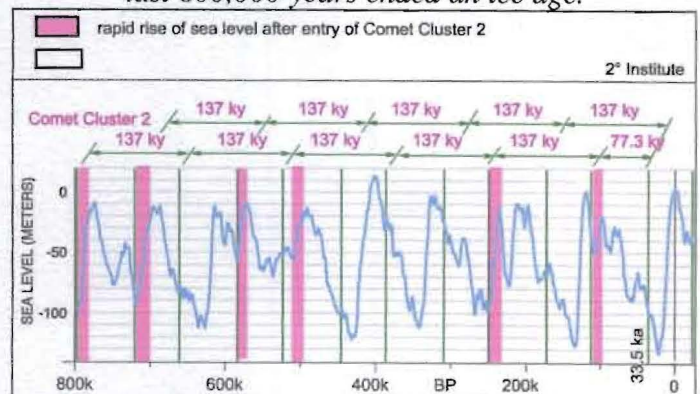
Each year Planet 1 travels

$$44,909 \text{ au} / 613,200 \text{ yr} = 0.0732 \text{ au/yr}$$

Planet 2

Six ice ages in the last 800,000 years ended because of Planet 2 with a period of 137,000 years.

Figure 4: Planet 2 created comet barrages with a period of 137,000 years. Six comet barrages in the last 800,000 years ended an ice age.



Half of each series comes from one side of the IOC, the rest from the opposite side.

Comets disturbed by Planet 2:

Let t_c = comet period = 137,000 years
 Let a_c = comet semi-major axis

By Kepler's second law, $t_c^2 = a_c^3$, and the long axis of the elliptical orbit is $2a_c$.

$$a_c = t_c^{2/3} = (137,000)^{2/3} = 2632 \text{ au}$$

$$2a_c = 5263 \text{ au}$$

For Planet 2:

Let t_p = planet period
 Let a_p = planet major semi-axis

Let the ratio between comet orbits to planet orbits be 3:1. Then:

$$t_p = 3t_c = 3(137,000 \text{ yrs}) = 411,000 \text{ yrs}$$

$$a_p = t_p^{2/3} = (411,000)^{2/3} = 5528 \text{ au}$$

Assume Planet 2 intersects the IOC plane perpendicular to the major semi-axis at f_p , the focus of the Sun, which allows both comet clusters to have the same period.

The radial distance from f_p to r_p where it intersects the IOC is $2a_c$, the distance the comets travel. From this distance, calculate e_p , the eccentricity of Planet 2.

$$r_p = a_p (1 - e_p^2) = 5263 \text{ au}$$

Solving for e_p :

$$e_p = (1 - 5263 \text{ au} / 5528 \text{ au})^{0.5} = 0.21895$$

Then the focus distance f_p is:

$$f_p = a_p e_p = 5528 \text{ au} * 0.21895 = 1210.3 \text{ au}$$

and the minor semi-axis b_p is:

$$b_p = a_p (1 - e_p^2)^{0.5}$$

$$= 5528 \text{ au} (1 - 0.047939)^{0.5}$$

$$= 5528 \text{ au} * 0.9757 = 5393.9 \text{ au}$$

Using the same logic as above, Planet 2 would pass through 24 au of IOC and send 345 - 890 comets per year toward Earth, or 1 - 2.5 per day.

Inner Oort Cloud

If the comet burst lasts 1000 years, the thickness of the IOC at 6940 au might be about half, 500 years, to allow for smearing. Converting to 500 years to au, the thickness of the IOC is:

$$44909 \text{ au} = \text{distance in one orbit for Planet 1}$$

$$44909 \text{ au} * (500 \text{ yr} / 613200 \text{ yr}) = 36.6 \text{ au}$$

The dimensions of the IOC can be estimated as a triangle with:

$$h = (10,000 - 2000) = 8000 \text{ au}$$

$$b = 37 \text{ au} * (8000) / (6940 - 2000) = 60 \text{ au}$$

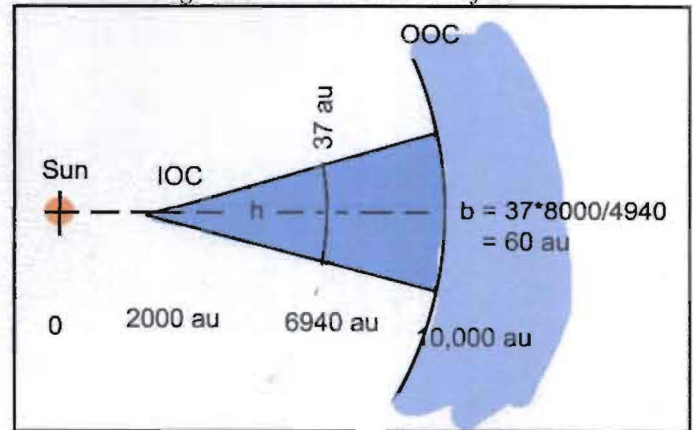
$$A = bh/2 = 240,000 \text{ au}^2$$

The radial distance of the center of mass is at $h/3$.

$$r = 2000 + 8000 * 2/3 = 7333 \text{ au}$$

$$V = 2\pi r A = 2 * \pi * 7333 * 240000 = 11 \times 10^9 \text{ au}^3$$

Figure 5: Cross-section of IOC.



If the number of comets in the IOC is $5 - 13 \times 10^{12}$, then each cubic au averages 455 - 1180 comets.

Far from the Sun, a planet with a mass of Jupiter has a sphere of influence of perhaps 1 au. A single passage will stir up a cylinder of comets 37 au long with a radius of 1 au and average density of 455-1180 comets per au^3 , giving 52,900 to 137,000 comets. Half will go outward toward the OOC, while the other half will go inward toward Sun, which represents 26,500 - 68,500 comets over 500 years, or 53-137 comets per year.

While comets from the OOC average 35 round trips, comets from the IOC interact more with planets, so perhaps they average 10 round trips. This balloons the frequency to 530 to 1370 comets per year, or 1.5-3.8 comets per day, a barrage.

Not every comet will circle the inner solar system, so perhaps 1 - 2 comets per day.

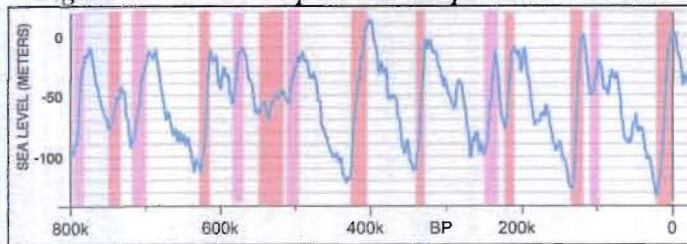
Planetoids represent 3% of these, so a planetoid would intrude 16 to 40 times a year, of which Sun would capture one or more of planet size over the course of each barrage.

Impact dates

Figure 6 and Table 1 combine impact dates from both sets of comet clusters. These two sequences account for every major rise in sea level. Note that beginning

300,000 years ago, some other mechanism created small rises in sea level.

Figure 6: Combined planetoid capture and kibble.



The impact in 20.3 ka BP marked the end of the last ice age. Sea level rose slowly for 5000 years until 15 ka BP when it accelerated after two captured planets were kibbled.

Table 1: Center of impact dates for Comet Clusters 1 & 2.

	CC 1 ka BP	CC 2 ka BP
1	20.30	33.50
2	136.30	110.80
3	224.70	170.50
4	340.70	247.80
5	429.10	307.50
6	545.10	384.80
7	633.50	444.50
8	749.50	521.80
9		581.50
10		658.80
11		718.50
12		795.80

What causes ice ages to end?

This paper proposes that each ice age ends when Sun captures a planet from the IOC in a retrograde orbit. Jupiter's gravity forces the intruder's orbit into the planetary plane. After some delay, Jupiter kibbles the intruder into a long string of fragments that generally follows the original orbit. Earth crosses this string once or twice a year and suffers a bombardment. Pieces that strike above an ice sheet ablate the ice, rapidly raise sea level and after thousands of years, end the ice age.

The same is not true for comets, whose impacts tend to form an aerosol around Earth that lowers temperature and lowers sea level.

Planets not comets

Although both comets and planets intruded in large numbers, only planets caused sea level to rise. An impact with a comet fragment incinerates the land below, just like an asteroid, but it tends to create a fog of ice crystals around Earth that lowers temperature.

This short-term effect occurred routinely with Comet Cluster Encke, which was captured at the same time as Rahu and Ketu. Each impact lowered sea level or halted sea level rise for 20 to 40 years. (Harris, 2018)

How to slow down a comet

Capture and destruction of a planet

Long-period comets enter the inner solar system at too high a velocity to be captured by the Sun. In some way they have to be slowed down to affect a capture. How?

Unlike comets from the OOC, those from the IOC lie in the same plane as the planets. When entering the solar system, they run a gauntlet of Neptune, Uranus, Saturn and Jupiter.

- If a comet passes a planet from the rear, it will gain speed and be ejected into the Outer Oort Cloud.
- If a comet passes a planet from the front, it will lose speed and can be captured.

For this reason, captures have a retrograde orbit. This is true for planets Nibiru, Ketu and Rahu and for Triton, the largest moon of Neptune.

What causes ice ages to begin?

Without comet-cluster barrages, sea level falls

For the last 800,000 years, sea level has fallen continuously until a comet-cluster barrage (Figure 6). The rate of decline is slow but steady, with no apparent relief as sea level falls ever deeper and ice sheets grow ever thicker. In general, the only thing that prevents this continuous decline in sea level is a comet-cluster barrage.

An exception to either rising or falling sea level may occur when most of the ice sheets have vanished; sea level appears to stay constant for a brief period before ice sheets resume expansion.

Earth does not need a cyclical mechanism to cause an ice age; the cyclicity comes from stopping an ice age. Earth's orbit is such that ice sheets would continue to expand if not for comet-cluster barrages. The pair of planets stirring up the IOC is what keeps us alive.

In the last 300,000 years, some additional mechanism has caused sea level to briefly rise 10 to 15 m before resuming a downward trajectory.

The current temperature rise due to high levels of CO₂ is a short-term effect that will disappear in the next thousand years after all fossil fuels have been exhausted.

Current location of Vasuki

Hindu mythology reported that the last comet barrage was stirred up by **Vasuki** in the celestial ocean. Because no other mythology references this entity, the name of Planet 1 is Vasuki, meaning 'open-mouthed serpent'. This description also applies to the constellation Hydra from whence it came.

Vasuki's position can be estimated from astronomy and from Hindu mythology. First determine how far Vasuki has traveled since passing through the IOC.

The comet barrage took 102,200 years to reach the Sun; during that time, Vasuki traveled

$$102,200 \text{ yrs} * 0.0732 \text{ au/yr} = 7481 \text{ au}$$

Since the last comet bombardment in 20,300 BP, Vasuki traveled

$$20,300 \text{ yrs} * 0.0732 \text{ au/yr} = 1486 \text{ au}$$

Taken together, Vasuki has travelled around the Sun $360^\circ * (8,967 \text{ au} / 44,909 \text{ au}) = 71.9^\circ$

Its angular velocity is

$$71.9^\circ * 3600 \text{ sec per deg} / (102,200 \text{ yrs} + 20,300 \text{ yrs}) = 2.11 \text{ seconds per year.}$$

In order for Vasuki's comet clusters to have equal periods, its orbit is perpendicular to the plane of the celestial equator in one direction, but slanted in the other, like the blade of a table-saw. The angle of the slant is not known.

The origin of the comet cloud lies embedded in the name **Vasuki** meaning 'Open-mouthed serpent'. Hindu artists picture Vasuki as a snake coiled around

the neck of Lord Shiva, who turned blue after swallowing poison that accompanied the serpent.

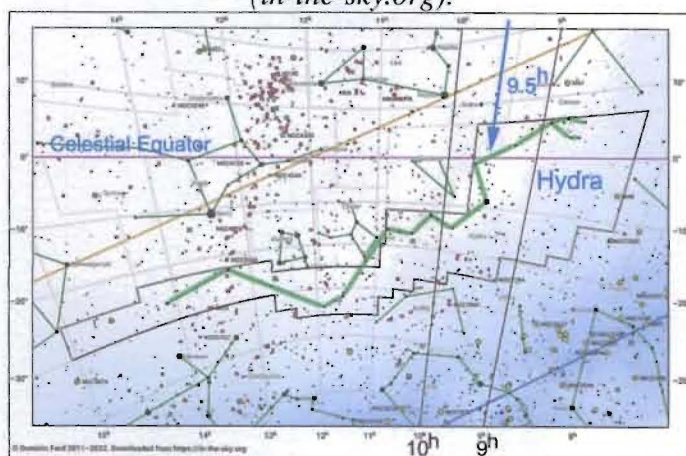
Its name suggests a constellation on the celestial equator, which would be Hydra the sea-serpent, where 'sea' means 'celestial ocean'. Its zig-zag design might depict the path of a comet traversing the Solar System as various planets altered its course.

Hindu astrology calls it **Ashlesha**, whose symbol is a coiled serpent. In Finnish, *Ahjs-lle saha* means 'metal for a saw', would be a nickel-iron meteorite.

Ashlesha is a star of dreadful nature. It is suitable for success in warfare, invocation of elements and other spirits, imprisonment, separations, acts of destruction, and the breaking of alliances with superiors. It is not suitable for auspicious undertakings. (Astrojoyti.com)

The plane of the IOC is identical with the celestial equator. Hydra crosses the celestial equator at 9:30 hours, which marks the direction of the singularity where the comets originated (Figure 7).

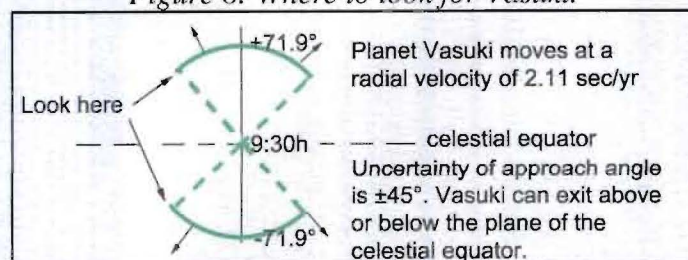
Figure 7: Hydra crosses the celestial equator at 9:30^h (in-the-sky.org).



Vasuki should be located at a radial distance of $\pm 71.9^\circ$ from a point on the celestial equator at 9:30 hours, traveling at a speed of 2.1 seconds per year (Figure 8).

Vasuki is probably a gaseous planet with many moons and satellites, 1-4 times the mass of Jupiter, diameter 140,000 - 220,000 km, distance 7400 au, with reflectance between Jupiter and Saturn.

Figure 8: Where to look for Vasuki.



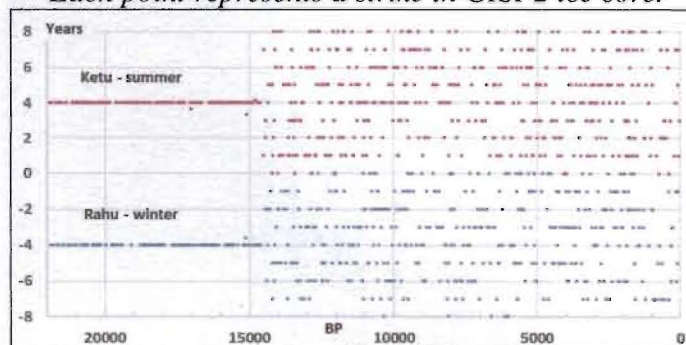
Example of a kibbled planet

Fifteen thousand years ago, sea level began rising at an astonishing rate of 5 cm a year for 500 years.

Simultaneously, ice sheets in Greenland began to trap immense spikes of ammonium generated by cosmic impacts. The largest impacts were spaced apart by multiples of sixteen years. Closer inspection revealed two sets of impacts, one in summer, one in winter, each with an orbital period of 16 years, separated by 8 years. That is, they appeared to come from two planets on opposite sides of a sixteen-year elliptical orbit accompanied by a cloud of satellites. As they passed by in summer or winter, they tended to strike Earth with a satellite that left a spike of ammonium in Greenland ice cores.

A chart of impacts in GISP2 ice core shows a different picture. For thousands of years, both planets had a regular 16-year orbit, and would usually hit Earth with a satellite (Fig. 9). Around 14,861 BP, a close encounter with Jupiter turned both planets into rubble. Remnants of the stricken planets continued along in the same orbit, but organized in a long string. Instead of passing Earth every eight years, fragments began to strike Earth in successive years. On average, the number of strikes tripled as did their amplitude. This massive bombardment is the principal reason that ice sheets vanished.

Figure 9: Deviation of strikes from 16-year period. Each point represents a strike in GISP2 ice core.



To understand these two planets requires analysis of the Hindu Creation Myth.

Hindu Creation Myth

Two observations, 'god in heaven' and 'immortality' survive in many religions, whose adherents have lost all knowledge of their celestial premise. Both phrases describe comets, not gods.

The *Samudra Manthana*, or 'churning of the celestial ocean', relates how two planets achieved immortality. The story is elaborated in four books: Vishnu Paurana, Bhagavat Purana, Padma Purana and Mahabharata (Trivedi, 2016).

Origin of Rahu and Ketu

Long ago, a succession of comets (**Devas, Gods**) and free-flying planets (**Asuras, Demons**) entered the Solar System, swung around Sun, then vanished back into **Kshira sāgara** meaning 'Ocean of Milk' for a thousand years. They originated in the cosmic ocean, stirred up by **Vasuki**, King of the Serpents.

Many Devas and Asuras died. Both Devas and Asuras sought immortality (**Amrita**) by orbiting the Sun within the solar system.

When Amrita was received from the celestial ocean, Devas and Asuras fought over it. When there was no end to the fight, **Vishnu** appeared in the enchanting form of **Mohini**, his only female avatar. Mohini is the same person as **Tiamat** 'the mother' of Babylonian mythology, with three times the mass of Earth and seven moons.

Both Devas and Asuras were smitten by the beauty of Mohini and agreed to her idea of distributing Amrita. Vishnu did not want the Asuras to consume Amrita as

this would make them immortal and free to create havoc. Therefore, Mohini first poured Amrita into the mouths of the Devas.

One Asura, **Svarbhanu**, got suspicious about the whole event and went and sat among the Devas. When Mohini poured Amrita into the mouth of the Asura, **Surya** (Sun God) and **Chandra** (Moon God), who were sitting nearby, recognized the intruder and alerted Mohini.

Quite unexpectedly, **Svarbhanu** was deflected into a 16-year orbit around the Sun. Alarmed that this demon planet had achieved immortality, Mohini took the form of Vishnu and cut the neck of Svarbhanu with his discus, **Sudarshana Chakra**. The head became the demon **Rahu** and the body became the demon **Ketu**. A third piece fell to Earth.

To avenge the separation, Rahu promised to periodically eclipse Sun and Moon.

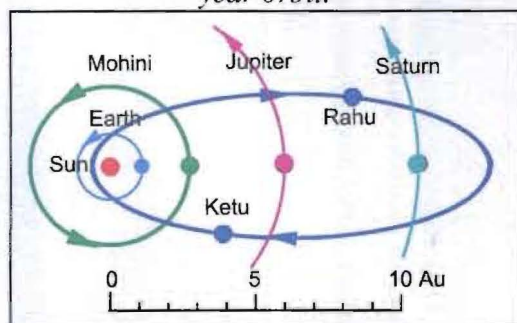
Next followed a furious war between planets and comets, with planets emerging victorious.

Properties of Rahu and Ketu

After the cleavage, Rahu orbited the Sun on a chariot pulled by eight black horses, while Ketu orbited on a chariot pulled by eight dusky horses. Each demon carried spears to throw at Earth, and each was at least half the diameter of Moon. Rahu eclipsed the Sun in mid-winter and Ketu eclipsed Earth's moon in mid-summer. Rahu approached from the direction of Leo the Lion, while Ketu approached from Aries the Goat.

For millennia, the demon pair circled the Sun on opposite sides of a 16-year, retrograde orbit (Figure 10).

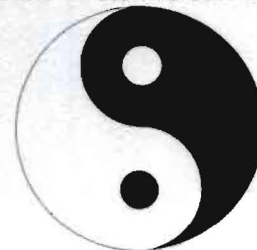
Figure 10: Twin planets on opposite sides of a 16-year orbit.



As a result of Mohini's cleavage, each planet hosted a cloud of satellites and a tail of debris. The Yin-yang

symbol represents these twin planets with a diffuse head and comet tail circling clockwise around the Sun.

Figure 11: Yin-yang symbol: a pair of planets with comet-like tails circle the Sun in opposition.



Their orbital period of 16 years was constrained by Jupiter, which had an orbital period of 12 years at a time when Earth had an orbital period of 358 days. The inner planets were in lock-step, in resonance with Jupiter. At nearly every passage, Earth would intercept a satellite, and some luckless region of Earth would be incinerated. Greenland ice sheets recorded each strike in the northern hemisphere as a spike of ammonium.

After thousands of years, the twin planets mysteriously disappeared. Hindu astrology preserved their memory as ghost planets of negative aspect, still able to influence the human condition.

Decipherment of Hindu names

In 20 ka BP, the only known language in Europe was Finnish, written in Old European script by mammoth hunters who came from the Middle East around 35 ka BP (Harris, 2011). By extension, Finnish might also have been the language of the Hindu creation myth. If so, proper names might translate into Finnish.

Amrita 'Elixir of immortality from the celestial ocean' < *Aja-meri-ta* 'Unknown age of the sea'

Ashlesha 'Vasuki' < *Ahjs-lle saja* 'Metal for a saw'

Asura 'Demon in the sky' < *Ahjs-ura* 'Metal trail'

Chandra 'Moon god' < *Akan tora* 'Woman's fight'

Devaloka 'place of the gods' < *Taivas lonka* 'Sky cloud-patch'

Ketu 'dragon's tail, meteor' < *kyy-tu* < *kyy-tuhoaja* 'Serpent destroyer'

Mohini 'female avatar of Vishnu' < *Emo-hini* 'My mother'

Rahu 'eclipse' < *Raju* 'fierce, violent'

Surya 'Sun god' < *Sur-j'a* < *Surri jumala* 'Great god'

Svarbhānu 'Splendor of Radiance' < *Ahjs vaara paha ennus* 'Metal danger evil omen'

Vasuki 'King of snakes coiled around Lord Shiva's neck' < *Aava-suu kyy* 'Open-mouthed serpent'

Vishnu 'the preserver' < *Viitsin uro* 'I tend man'

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