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Possible Ancient Observation of Disintegrated Comet Impact In Southern Tibet

Author: Mahesh U. Patil

Key Words

Comets, Ganga, Orion, Eridanus, Mahabalipuram

Abstract

Role of comets and icy asteroids in getting water to Earth is under discussion for last few decades. In the recent history, we have observed and recorded two comet impact events in the solar system. Both the impacts of Solwind and Shoemaker-Levy-9 indicate that the impacts by comets may be a regular feature and Earth is no exception to it. In the history of mankind, there is a strong possibility that such events were observed by various civilizations. Early settlements of ancient India observed various celestial objects like stars, constellations, planets and comets. Vedas like Rigveda, Atharvaveda refer comets as "Dhumketu". Reference of these celestial bodies is found in various ancient legends of India. Though these legends are work of imagination, some of the reference may be based on real observations. One such legend that may be based on the impact event, is descent of Ganga from heaven. Many aspects of this legend like its composition, appearance, descent path and effects at the time of descent have close resemblance with the impact event of celestial body like comet. Ancient Stone carvings depicting the event, provide major clue about the celestial movement and the impact event. In this paper we have used ancient symbolism, descriptions, and compared them with modern scientific facts and geological features of the region described in the legend. There are Multiple water bodies and lakes in Tibet behind mount Kailash. This lake region is rich with minerals that are usually associated with the impact site. These lakes play crucial role in the water cycle of Asia .Though there are lot of similarities in the legend and the available facts, as on date there is no conclusive evidence which can prove the origin of river Ganga as a result of this event as mentioned in the legend. Thus, this legend may be a result of observation mixed with belief.

Introduction

Presence of water on planet earth raises many questions about its origin. Role of Comets and icy asteroids in getting water to earth is under discussion for many decades. Deuterium level of ocean water supports the Comet argument. In the initial period, earth might have come across heavy bombardment from these objects due to gravitational pull and push of the planets like Jupiter and Saturn. However, these impacts are not restricted only to the initial formation process, and at regular interval Earth and other terrestrial planets have come across impacts by large asteroids and comets. In 1977 Wetherill suggested that the half of the terrestrial impact craters could have been produced by retrograde comets. To differentiate impact craters of these low-density objects, Roddy et.al 1976 [1] and O'Keefe et.al 1982[2] proposed various models that can explain formation of flat floor, multi ring craters. However, except Flynn creek not too many sites are known or studied for comet impact. In the recent past we have observed impact of Solwind and Shoemaker-Levy 9, even the Tunguska event is under discussion for possible comet impact. Hence there is a strong possibility that modern science is missing something while studying impacts by these low-density objects. There is a strong possibility that many such events were observed and may be recorded by early human settlements. Hence there is no harm in considering their viewpoint, however the main challenge is the method followed by the ancient civilizations for recording and communicating these observations. In ancient India one such event is recorded in the form of story which talks about water coming to earth from outer space in the form of river Ganga. Rivers are the main source of drinking water so they are respected in every culture. Rivers like Nile, Yangtze, Danube and other major rivers had a deep influence on the human civilization but no river is considered as holy as Ganga. This respect for Ganga is not restricted to any religion or region. For ages scholars, philosophers and rulers across the world were attracted to the banks of Ganga and this attraction continues till date. One of the reasons for this attraction lies in the story of its celestial origin with the particular day of descent known as "Ganga dashmi" or "Ganga Dussehra". This story has such a deep impact on the Indian belief system that though this river flows from Himalayan mountains to the planes of northern India and ends at Bay of Bengal, people across India worship this river as goddess. Many sculptures and large stone carvings depicting even minute details of the story of its descent are well preserved

in the temples of southern India. Apart from religious belief this story has a deep impact on art, literature and dance. In Bharat Natyam (Dance Form) story of its descent is depicted as Tanadav (Vigorous dance of Creation by lord Shiva) . This influence of Ganga became more mysterious in the context of early Indian settlements, which were around the banks of Indus (Sindhu) and Saraswati. Even in the oldest text of Rig Veda, rivers like Saraswati and Sindhu (Indus) has got more importance. For some strange reasons Ganga became important river in the ancient literature (Purana), later Vedic writings, Ramayan and Mahabharat. This sudden shift in belief system and story of celestial origin with various astronomical reference and dates raise many questions. If we keep the belief aside and focus on the framework of story then it provide many clues which can be verified on the scientific parameters. In this study we have compared ancient references and modern perspective/scientific facts.

Method

The Ancient References Vs Scientific Facts or Modern Perspective

Discussion

Basic Framework Of Legend: As per the legend king Bhagirath performed a penance to bring Ganga the daughter of Himavan, from heaven to the Earth. When lord ordered Ganga to descend on Earth, there was a threat that Earth will not be able to handle its velocity or force. Thus lord Shiva agreed to hold Ganga in his hair (Jata). With great force Ganga fell on the head of Shiva but got trapped in the hairs. For several years it kept revolving in the hairs of Shiva and despite of all her efforts she could not come out of it. Bhagirath once again requested lord Shiva to release Ganga on earth. Granting his request lord Shiva released Ganga from his hair in 7 parts or streams. Three main streams fell on the eastern side, 3 on the western side and 7^{th} stream followed the chariot of Bhagirath in the sky in all the directions where ever Bhagirath went . At the time of its descend on earth (Ganga Avataran) gods and demi gods gathered to witness this event and their presence irradiated heaven (sky) as if thousand suns had risen. Ganga created lot of turbulence on the Earth, this act disturbed sage Janu who swallowed Ganga. On request of Bhagirath to release its holy water sage Janu released Ganga from his stomach.

Description Of Ganga And Similarities With Celestial Object

Ancient References

Ganga, daughter of Himavan was moving in the heaven (word "hima" is used for snow, e.g. Himalaya means abode of snow). Ancient Indians had knowledge about Icy objects like comets which revolve around the Sun. In Sanskrit comets are known as Dhumketu (Dhum means Smoke and Ketu is depicted as tail of demon snake). This name explains the appearance of comet in the terrestrial planet zone where it starts forming tail due to radiation effects. There are three ancient references which hint towards close resemblance of Ganga with comet.

A) The famous Ganga avatarn sculpture at Mahabalipurm depicts Ganga in the form of 3 ketus (as 3 streams descending on earth) (Figure 1). As described earlier in Sanskrit Comet is known as "Dhumketu" (Dhum is smoke and Ketu is depicted as tail of demon snake).

B) Sculpture at Kailasnath Temple Kanchipuram, depict Ganga as celestial body with tail near Orion and Canis Minor (Figure 2)

C) As per "Shreemad Bhagvat" 10.70.44 [3] Transcendental water of Ganga travelled throughout entire universe in higher, lower planetary system and Earth. In higher planetary system it's called "Mandakini" ("She who Flows Calmly/ Elegantly") in lower planetary system it's known as "Bhogavati" ("serpent river" - maybe because of tail formation) and on Earth its known as Ganga. These three stages hint towards a celestial body like Comet which came from beyond Jupiter region and change its shape (serpent shape) before impacting the Earth.

Scientific Facts And Modern Practices:

In our solar system icy bodies are beyond asteroid belt. They are in the form of asteroids, comets, moons and planets. Comets are concentrated on the extreme edge of the solar system near the Oort cloud and Kuiper belt and keep orbiting around the Sun. According to modern science Earth has got most of its water by impact of icy objects like asteroids and Comets. Deuterium level in the ocean

water is similar to water found in comets, thus modern science believe that comets may have played a major role in getting water and life to our planet. When it comes to referring these objects, even today we intend to refer these various celestial objects with their names rather than its composition, e.g., comets like Hale Bopp, Halley are known by the names of people who discovered them.

Figure Of Ketu in Ganga Avataran Mahabalipuram

Figure 1: Stone carving at Mahabalipuram depicting descent of Ganga.

Why Descent Of Ganga Was Dangerous

Ancient Reference

When lord asked Ganga to descent on Earth for welfare of humanity, she was unwilling to go and threatened that the Earth will not be able to take Vega (velocity) of her descent. It may cause destruction on earth.

Scientific Facts: Threat Of Comet Impact

It's a known fact that the hyper velocity impact of large asteroids and comets are capable and responsible for destruction and mass extinctions from Earth in the past. Shoemaker-Levy 9 event has drawn attention of the world to this threat. Even Tunguska event is under discussion for possibility of a impact by a small comet.

Celestial Reference and Its Position In The Night Sky

Ancient Reference

Considering the threat, lord Shiva agreed to hold Ganga on his head. With great force Ganga fell on the head of Shiva and followed the path of Strotashwini (Eridanus) while heading towards the Earth. In the celestial context Shiva is also known as Natraj or Dakshinmurthy and represented by constellation Orion. Eridanus is called strotaswini (meaning "course of river Ganga"). This event is very well covered in sculpture in "Kailasanatha temple, Kanchipuram" and few other temples in southern India, which depict Shiva as Gangadhar (One who is holding Ganga) (Figure 2). A 5000 year-old ancient rock painting in Burzahom, Kashmir, also represent a semi-circular bright object above the constellation Orion which may be a comet, (Figure 3).

As per one of the version of the story, this event occurred on Saptami (7^{Th} day) of Vaishakh month's shukla paksha (waxing Moon) thus known as Ganga Saptami. Sculpture hint towards 4 key references of the night sky.

1) Canis Minor (depicted as dog in most of the ancient cultures) 2) Orion 3) Lady which may be representing Eridanus/Strotashwini 4) Ganga represented as Celestial Body with Tail.

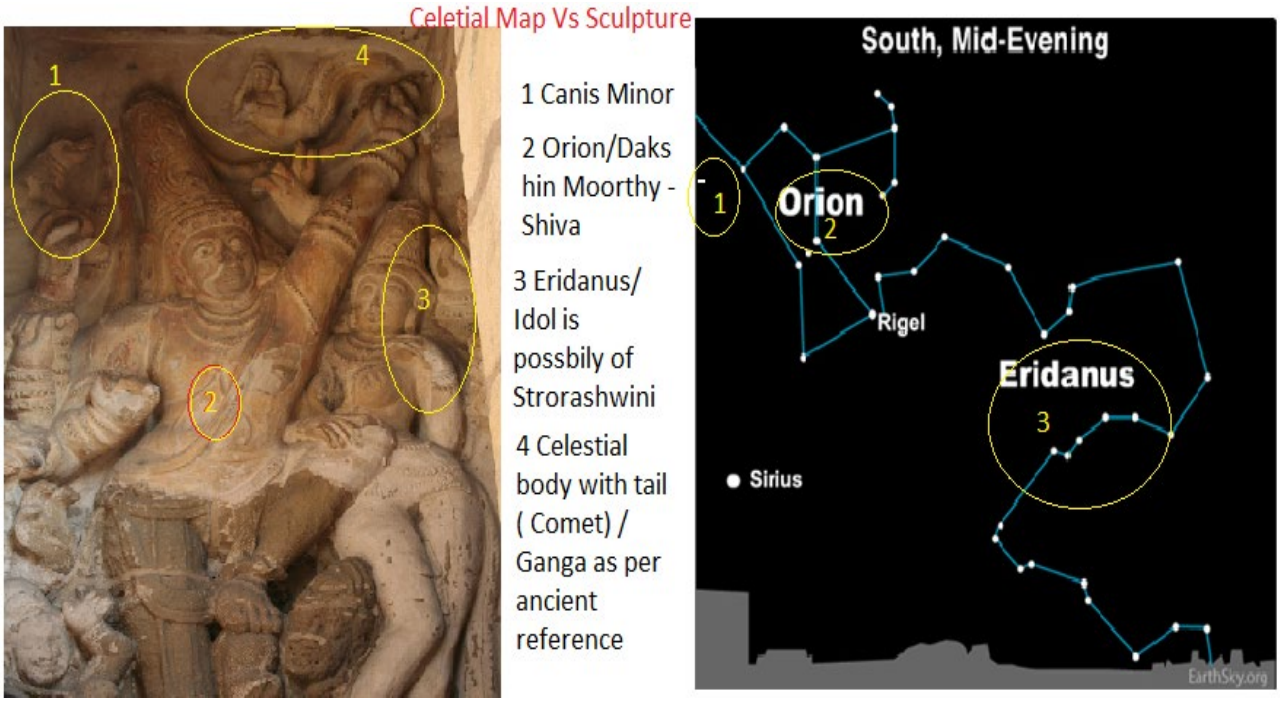

Figure2 : Sculpture at Kailasanatha temple, Kanchipuram

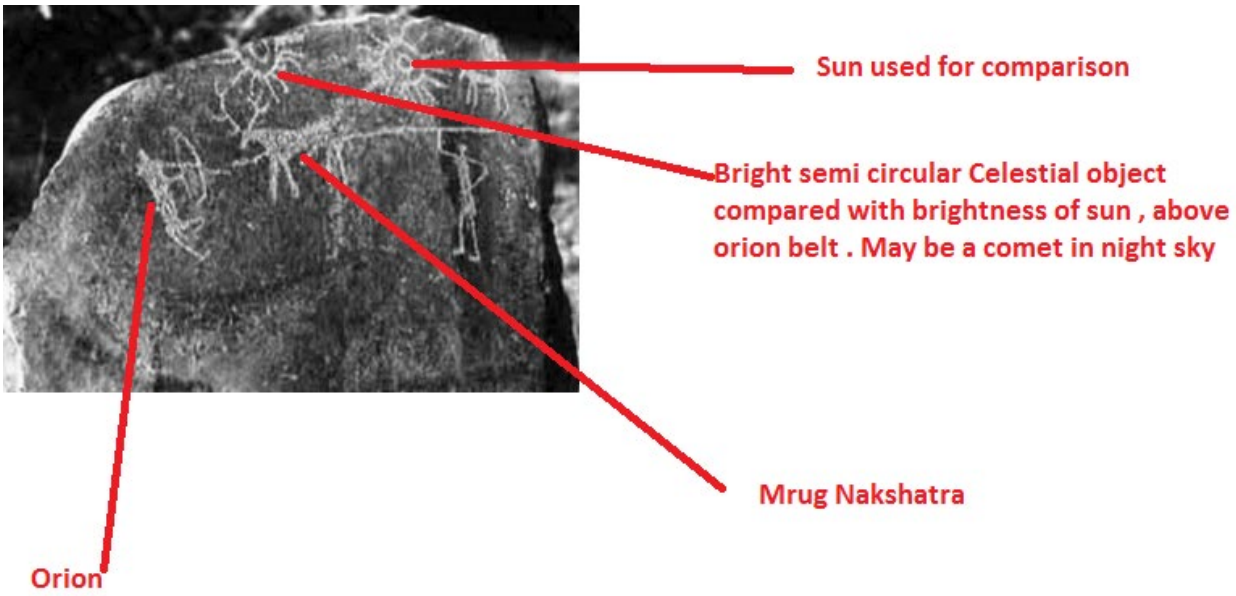

Figure 3: Rock art of Burzahom, Kashmir. Hunter is Orion with bright circular body above head of a deer (Mrug Nakshatra)

Modern Perspective

Even today we refer constellations to spot the locations in the night sky.

Disintegration oF Ganga In Space

Ancient Story

After appearing on the Shiva's head (Dakshinmoorthy/Orion), Ganga was trapped in his hair (jata) and despite of many efforts she could not come out of the Shiva's hair. Ganga kept revolving for many years. During this period she disappeared from the sight. Concerned with this Bhagirath (Who brought Ganga on Earth) requested lord Shiva to release Ganga. Granting the wish of Bhagirath Shiva released Ganga which got disintegrated in 7 parts. These seven parts formed 7 streams which fell on the Earth.

Scientific Facts

Comets from Oort cloud and Kuiper belt that are deflected by Jupiter's gravity undergo change of orbit and are trapped in terrestrial planet zone. Such comets are known as short period comets. These comets can have orbital period of 5-6 years, due to this short orbit they keep appearing and disappearing at regular intervals. These short period comets tend to disintegrate under the influence of Sun's radiation and tidal forces in the terrestrial planet zone (Figure 3). There are multiple evidences of disintegration, in the recent history we have observed and recorded the impact of disintegrated Comet "Shoemaker-Levy 9" with Jupiter. Thus, both the points that Ganga kept on revolving for many years and disintegrated in 7 parts have similarities with properties of short period comet.

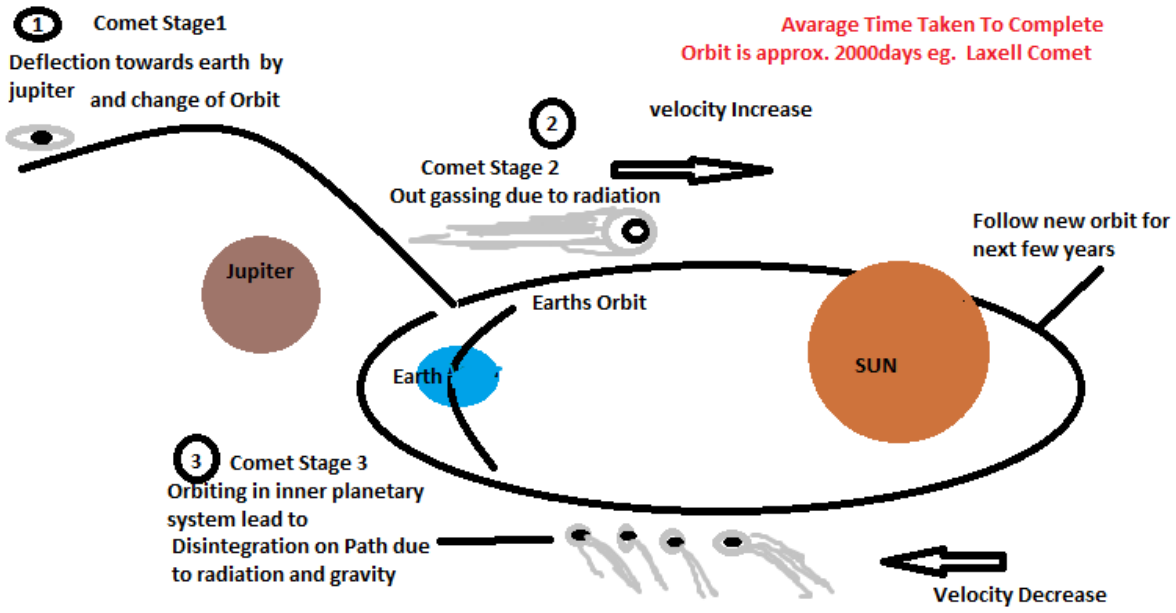

Figure 3: Artistic presentation of disintegration of comet

Impact Event of Ganga and Impact Location

Ancient Reference

As per the legend it was a grand event, In Ramayana its mentioned that not only humans and animals but even gods from the heaven gathered to witness this event and their presence irradiated heaven (sky) as if thousand suns had risen. As per legend on the 10th day (dashmi) of the waxing moon (Shukla Paksha) of the Hindu calendar month Jyeshtha (Period Between May and June), 3 main streams of Ganga landed on eastern side and three landed on western side (*with reference to mount Kailash*) 7th stream followed the chariot of Bhagirath in the sky and went in all directions. This event is very well depicted in the ancient sculpture at Mahabalipuram "descent of Ganga" (Figure 4) which showcase 3 main streams falling on the Earth with gods, animals and humans are observing this event with curiosity.

Modern Perspective and Scientific Facts

In case of Shoemaker-Levy 9 impact, we have observed each fragment impacting at different time interval creating east to west pattern. It's quite possible that these

7 fragments entered in the Earth's atmosphere over a period of short duration and due to Earth's rotation this appeared as East to West impact pattern. These fragments once entered in the Earth's atmosphere would have undergone plume formations, which may have been assumed or interpreted as streams falling from the sky. In the event of impact by icy objects Some fragments may impact the Earth but small fragments may airburst similar to Tunguska event. Thus, legend may be hinting towards 6 impacts and one (7^{th} fragment) airburst which went in all directions.

If we look at the area behind *Mount Kailash*, we can observe multiple lakes. These lakes have Deuterium enrichment with sharp fluctuation around 6000 years back. Gravitational anomaly is observed in this lake region (6-8 dark blue patches) (Figure 5). This is a common feature in the event of hyper velocity impacts.

Dilemma of Modern Science : Comet Impact or Comet Airburst (vaporize)

O'Keefe, Roddy and others have tried to understand the impact of low-density objects like Comets. They have tried to differentiate the impact craters of comet from asteroids. This work can help us to understand many other possible impact sites but till date most of the investigations are carried out basis impact features of rock and metal asteroids having density of $\geq 1 g/cm^3$. One of the reasons for this is a general belief/assumption in the modern science, that fragile objects like comet will vaporize or airburst due to friction with Earth's atmosphere. To an extent it may hold true for smaller fragments but may not apply in every case. We cannot ignore two key observations in the recent human history. 1) 30 Aug 1979, when comet C 1979 Q1 (Solwind) impacted the surface of the Sun. 2) July 1994 When Comet Shoemaker-Levy 9 entered Jupiter's atmosphere and formed large plumes before impact. Both the events substantiate the fact that the Comet can survive extreme temperatures and atmospheric conditions and may not vaporize instantly. These two observations in such a short interval also force us to think about the frequency of such events.

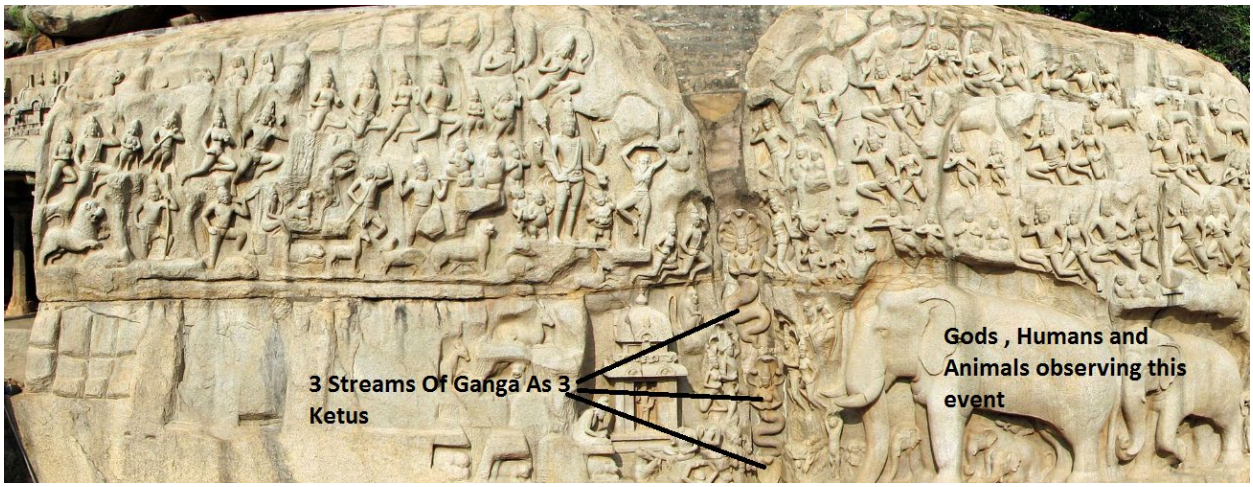

Figure 4 : Stone Carving at Mahabalipuram

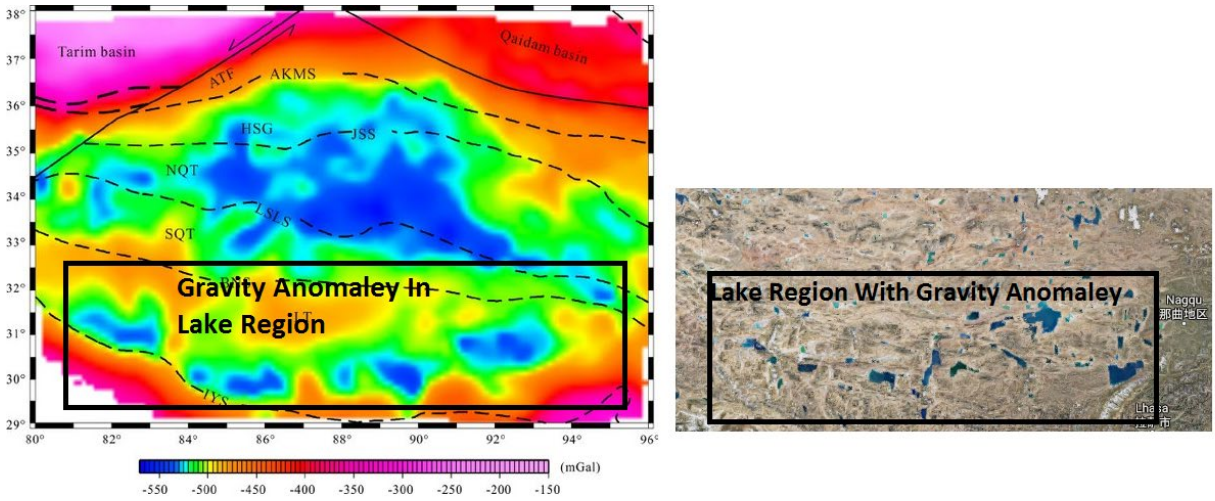

Figure 5: Lake region in Tibet and its gravity anomaly map showing 6 to 7 spots which could be outcome of impact.

After Effects of Impact and Other Developments.

Ancient Reference

Despite of Shiva holding Ganga in his hair for several years and disintegrating it at the time of release, streams of Ganga fell on the Earth with lot of energy and making lot of noise, as per Ramayana sky (heaven) was irradiated as if thousand

suns had risen there. On impact rushing water of Ganga created lots of turbulence. This act disturbed Sage Jahnu and he Swallowed water of Ganga to punish this act. On request of Bhagirath and others to release this holy water to fulfill their need, sage released Ganga.

Modern Perspective

Eyewitness accounts of Tunguska, Cheliyabinsk, meteor have described the bright light, noise level and shock wave of such events. Such impact events create ultrahigh pressure and temperature and cause lot of disturbance that may have long lasting effects on the geology. This brings many physical and chemical changes on the ground. If we look at the Lake region of Tibet we will find lot of faults and fractures interconnecting these lake, such faults are developed in ultrahigh pressure event. It's possible that impact lade to formation these lakes and water started trickling down thru these faults and started new network of water channels above and below the surface. These lakes are source of Yarlungzangbo River (Bramhaputra).

There are many unique minerals reported from Yarlungzangbo region of Tibet which can be associated with the impact event, as described by Patil et.al. [4]. Minerals like cubic Boron Nitride, Boron carbide in natural environment are exclusive to Tibet and can be explained only by either impact event or deep mantle origin, impact of a comet provide a better explanation for their existence. Finds like osbornite (tin), coesite after stishovite, microdiamond in the region, strongly support the possibility of impact.

Disconnect

Ancient Reference

As per legend and belief Ganga originate from lake Manas which is near mount Kailash. From this location it travels underground and appear at Gangotri/Gomukh (Figure 6).

Scientific Facts

These lakes are behind mount Kailash in the region further away from Manas lake and they spread over a much larger area. These lakes are source to Yarlungzangbo

(Bramhaputra) (Figure 6) but as one date there is no evidence that these lakes are connected to river system of Ganga in any way. It also does not provide any clue whether this event was responsible to start the river system of Ganga.

Assumption of Vantage Point

If we assume that this event was observed from foothills of Himalaya (Figure 6). Then observer will see plume formation in the sky above Himalayan region. Since Mount Kailash has a great importance in the belief system of India for ages, it would have been referred as the point to spot the impact location. Thus, this event would have been recorded as three main Streams (Plumes) falling on the east direction and three others in the west direction of mount Kailash. Location of Impact, behind Mount Kailash and spotting of comet over Orion (Dakshinmoorthy/Shiva) might have played a key role in the association of Shiva with impact event as described in the legend.

Figure 6: Location of Gangotri, Mount Kailash, Proposed Impact Zone and Yarlungzangbo/Bramhaputra

Conclusion

The legend of Ganga has many similarities with the impact event of comet that might have occurred in the southern Tibet behind mount Kailash. Various stone carvings and descriptions in the local legend indicate the similarity with impact of celestial body. Modern findings of rare minerals, gravitational anomaly and other findings support the impact possibilities. The lakes in the proposed impact region play important role in the water cycle of Yarlung Zangbo (Bramhaputra), however

as on date no evidence is available that can co relate these lakes in the possible impact sites with the source of river Ganga. It also does not provide any evidence that the flow of existing river Ganga was initiated as a result of this impact. Thus, it's possible that the legend was a result of observations mixed with belief. This legend also supports the modern belief that comets might have played a crucial role in getting water to the planet Earth.

Reference:

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Appendix

We express our gratitude towards the great work of Maharshi Ved Vyas.

|| इदं न मम ||

Meaning: "This is not Mine" or "Not my will but Thy will be done".