

KUIPER BELT, OORT CLOUD – A PURANIC INSIGHT

(K. Vidyuta, Ph. D. Research Scholar, K. S. R. Institute, Chennai)

In ancient India outstanding contributions have been made in the realms of literature and art, religion and philosophy and they have gained world-wide appreciation. Contribution of India to medicine also is well known. So too, in the field of mathematics, India's genius is recognised to some extent. But India's glorious inventions in the field of science remain unnoticed.

The Purāṇas, as a form of literature having a long tradition, are considered as repositories of Ancient Indian History and Culture. They contain two components *viz.*, (i) the esoteric part and (ii) the mundane aspects about life in this earth. To understand the real purport of the Purāṇas both the above mentioned aspects must be taken into consideration.

When a concept has to be revealed in a detailed manner, encompassing many aspects, the Purāṇas adopted the method of transmuted parables. In these parables one can find scientific ideas in addition to the explicit philosophical ideas, cultural and historical facts.

A couple of Puranic concepts relating to the story narrated by Maināka mountain and the birth of Nārada is taken up in this paper to be analysed on the lines of the modern geographic concepts known as Kuiper belt and Oort clouds.

KUIPER BELT:

The Kuiper belt sometimes called the Edgeworth–Kuiper belt is a circumstellar disc in the Solar System beyond the planets, extending from the orbit of Neptune (at 30 AU) to approximately 50 AU from the Sun. It is similar to the asteroid belt, but it is far larger — 20 times as wide and 20 to 200 times as massive.

Like the asteroid belt, it consists mainly of small bodies, or remnants from the Solar System's formation. Although many asteroids are composed primarily of rock and metal, most Kuiper belt objects are composed largely of frozen volatiles (termed "ices"), such as methane, ammonia and water. The Kuiper belt is home to three officially recognized dwarf planets: Pluto, Haumea, and Makemake. Some of the Solar System's moons, such as Neptune's Triton and Saturn's Phoebe, are also thought to have originated in the region.

The Kuiper belt is thought to consist of planetesimals, fragments from the original protoplanetary disc around the Sun that failed to fully coalesce into planets and instead formed into smaller bodies, the largest less than 3,000 kilometres (1,900 mi) in diameter.

Analysis indicates that Kuiper belt objects are composed of a mixture of rock and a variety of ices such as water, methane, and ammonia. The temperature of the belt is only about 50 K, so many compounds that would be gaseous closer to the Sun remain solid. The densities and rock–ice fractions are known for only a small number of objects for which the diameters and the masses have been determined. The least dense objects are thought to be largely composed of ice and have significant porosity. The densest objects are likely composed of rock with a thin crust of ice. There is a trend of low densities for small objects and high densities for the largest objects. One possible explanation for this trend is that ice was lost from the surface layers when differentiated objects collided to form the largest objects.

The presence of Neptune has a profound effect on the Kuiper belt's structure due to orbital resonances. Over a timescale comparable to the age of the Solar System, Neptune's gravity destabilises the orbits of any objects that happen to lie in certain regions, and either sends them into the inner Solar System or out into the scattered disc or interstellar space. The currently accepted hypothesis for the cause of

absence of objects with semi-major axes below 39 AU is that as Neptune migrated outward, unstable orbital resonances moved gradually through this region, and thus any objects within it were swept up, or gravitationally ejected from it.

Modern computer simulations show the Kuiper belt to have been strongly influenced by Jupiter and Neptune, and also suggest that neither Uranus nor Neptune could have formed in their present positions, because too little primordial matter existed at that range to produce objects of such high mass. Instead, these planets are estimated to have formed closer to Jupiter. Scattering of planetesimals early in the Solar System's history would have led to migration of the orbits of the giant planets: Saturn, Uranus, and Neptune drifted outwards, whereas Jupiter drifted inwards.

OORT CLOUD:

The Oort cloud (named after the Dutch astronomer Jan Oort), sometimes called the Opik–Oort cloud, is a theoretical cloud of predominantly icy planetesimals believed to surround the Sun to as far as somewhere between 50,000 and 200,000 AU (0.8 and 3.2 ly). It is divided into two regions: a disc-shaped inner Oort cloud (or Hills cloud) and a spherical outer Oort cloud. Both regions lie beyond the heliosphere and in interstellar space. The Kuiper belt and the scattered disc, the other two reservoirs of trans-Neptunian objects, are less than one thousandth as far from the Sun as the Oort cloud.

The Oort cloud is thought to be a remnant of the original protoplanetary disc that formed around the Sun approximately 4.6 billion years ago. The most widely accepted hypothesis is that the Oort cloud's objects initially coalesced much closer to the Sun as part of the same process that formed the planets and minor planets, but that gravitational interaction with young gas giants such as Jupiter ejected the

objects into extremely long elliptic or parabolic orbits. Simulations of the evolution of the Oort cloud from the beginnings of the Solar System to the present suggest that the cloud's mass peaked around 800 million years after formation, as the pace of accretion and collision slowed and depletion began to overtake supply.

The outer limit of the Oort cloud defines the cosmographical boundary of the Solar System and the extent of the Sun's Hill sphere. The outer Oort cloud is only loosely bound to the Solar System, and thus is easily affected by the gravitational pull both of passing stars and of the Milky Way itself. These forces occasionally dislodge comets from their orbits within the cloud and send them toward the inner Solar System. Based on their orbits, most of the short-period comets may come from the scattered disc, but some may still have originated from the Oort cloud. Astronomers think that long-period comets (those with orbital periods longer than 200 years and possibly Halley-type comets) have their origins in the Oort Cloud. Based on their orbits, it is suggested they were long-period comets that were captured by the gravity of the giant planets and sent into the inner Solar System. If analyses of comets are representative of the whole, the vast majority of Oort-cloud objects consist of ices such as water, methane, ethane, carbon monoxide and hydrogen cyanide.

The inner Oort cloud is also known as the Hills cloud, named after Jack G. Hills, who proposed its existence in 1981. Many scientists think that the Hills cloud formed from a close (800 AU) encounter between the Sun and another star within the first 800 million years of the Solar System, which could explain the eccentric orbit of 90377 Sedna, which should not be where it is, being neither influenced by Jupiter nor Neptune, nor tidal effects. It is then possible that the Hills cloud would be "younger" than the Oort cloud. Bodies in the Hills cloud are made mostly of water, ice, methane and ammonia.

Gravitational interaction with nearby stars and galactic tides modified cometary orbits to make them more circular. This explains the nearly spherical shape of the outer Oort cloud. On the other hand, the Hills cloud, which is bound more strongly to the Sun, has not acquired a spherical shape. Recent studies have shown that the formation of the Oort cloud is broadly compatible with the hypothesis that the Solar System formed as part of an embedded cluster of 200–400 stars. These early stars likely played a role in the cloud's formation, since the number of close stellar passages within the cluster was much higher than today, leading to far more frequent perturbations.

STORY NARRATED BY MAINĀKA:

It is believed that in Kṛta yuga all mountains had wings. They flew all over the world with the swiftness of Garuda or Vāyu. All beings including Ṛṣis and Devas lived in a state of suspense since at any moment any mountain might fly and land down on their heads. They complained to Indra and Indra asked the mountains to remain at one place which they flatly refused. Indra got angry and started cutting down the wings of the mountains with his Vajrāyudha. No mountain was able to escape from this punishment; but Vāyu carried away his bosom friend, the mountain Maināka, and put it in the ocean without anybody noticing it. So Maināka alone did not lose its wings. It was this Maināka which rose from the ocean and gave a resting point to Hanumān, son of Vāyu, when he took a leap from the shores of Bhārata to Laṅkā. This was but an expression of gratitude to Vāyu for the help he had given when Indra was cutting off the wings of all mountains (*Vālmīki Rāmāyaṇa*, V. 1. 122cd-26):

... .. । पूर्वं कृतयुगे तात पर्वताः पक्षिणोऽभवन् ॥

तेऽभिजग्मुर्दिशः सर्वा गरुदानिलवेगिनः । ततस्तेषु देवसङ्घाः सहर्षिभिः ॥

भूतानि च भयं जग्मुस्तेषां पतनशङ्कया । ततः क्रुद्धः सहस्राक्षः पर्वतानां शतक्रतुः ॥
 पक्षांश्चिच्छेद वज्रेण तत्र तत्र सहस्रशः । स मामुपगतः क्रुद्धो वज्रमुद्यम्य देवराट् ॥
 ततोऽहं सहसा क्षिप्तः श्वसनेन महात्मना । अस्मिँल्लवणतोये च प्रक्षिप्तः प्लवगोत्तम ॥

NĀRADA'S BIRTH:

Nārada was the son of Brahmā, born from his lap. Brahmā mentally created the famous Saptarṣis – Marīci, Aṅgīras, Atri, Pulastya, Vasiṣṭha, Pulaha and Kratu. From Brahmā's anger was born Rudra, from his lap Nārada, from his right thumb Dakṣa, from his mind Sanaka and others and from his left thumb a daughter called Vīranī. (*Devī Bhāgavata*, 5th Skandha).

The Purāṇas refer to more than seven prominent births of Nārada. He was first born as the son of Brahmā and after that, on account of Brahmā's curse he was born as the Gandharva called Upabarhaṇa. Following that he was born as the son of emperor Drumila and was named Nārada. Again born as the son of Brahmā under the name Nārada, he married Mālatī and ended his life as a monkey. He was again born as the son of Brahmā and was cursed by Dakṣa. Afterwards he was born as the son of Dakṣa and also as a worm. All these births did not occur in one and the same *Manvantara*.

The *Brahmavaivarta Purāṇa* (*Br. Vai. P.*) gives the story of Nārada being born as the son of Drumila, the emperor of Kanyakubja through his wife Kalāvati through the boon of Kaśyapa. In the narration it is said that at the birth of the child it rained in the land which was suffering from drought and so the child was named Nārada, meaning, "he who gives water" (*Br. Vai. P.*, I. 21. 7):

अनावृष्ट्यवशेषे च काले बालो बभूव ह ।

नारं ददौ जन्मकाले तेनायं नारदाभिधः ॥

SIMILARITIES BETWEEN THE ABOVE MENTIONED PHENOMENA:

Usually when Puranic concepts are compared with modern ideas three things must be taken into account. They are: (i) The intended concepts; (ii) The sequence and (iii) The Time period.

So when the four phenomena are purveyed together keeping in mind the above three factors, one can find some similarities. For example, the Time period of the above phenomena are similar.

Though the Purāṇas are allegorical in their narration, they reveal the fact that there has been a consistent series of cosmic impact and geothermal events linked with their cause-and-effect relationships.

The ancient Indians never saw the earth, planets, stars and the five elements as mere physical features of the universe, but as divinities in different forms. In the same way can one say that they allegorised the comets or meteors to be the flying mountains that fell frequently on earth as in the story narrated by Maināka? If so then the story of Indra cutting their wings with Vajra can be assumed to be some cosmic impact between the comets and the other planets.

Though today most comets are in orbits farther away from the Sun than the Neptune, computer simulations show that, they were originally far more common in inner parts of the solar system.

From the fact that Kuiper belt contains short-period comets and also from the fact that the modern astronomers say that the present position of the Kuiper belt is due to its drift outwards due to Jupiter-Neptune's resonance, it seems probable that many comets struck earth and remaining other particles remained in the belt to form small planets. Those comets that struck earth may have developed into mountains. So, probably this leads us back to the story of Maināka saying that after Indra cut off

the wings the mountains remained stationary. Thus we can see that the concept of comets in Kuiper belt and the Puranic story of winged mountains are similar.

As narrated by Maināka and as per modern view both these phenomena are supposed to have occurred during the early period of the formation of the Earth (*purvam kṛta yuge...*).

The origin of water on Earth or the reason that there is clearly more liquid water on Earth than on the other rocky planets of the Solar System, is not completely understood by the modern geologists.

There are many hypotheses regarding this topic. One such hypothesis and the popular one is that the water now present on earth must have been contributed by Comets, Trans-Neptunian objects or water-rich meteoroids from the outer space and some large planetary embryos from beyond 2.5 AU.

Kuiper belt objects are termed as Trans-Neptunian objects and these objects are said to contain frozen volatiles. We have already seen that some short-termed KBO's struck earth during its formation. So we can say that the ice compounds present in the comets settled on earth as water and the solid compounds remained on earth to form mountains.

Water may also have been contributed by long-period comets that originated from the Oort clouds. As mentioned before, modern astronomers say that Oort cloud contains long-period comets. Also, the Oort cloud objects are also said to contain lots of water content in the form of ices and other gases.

As per the Purāṇas that Nārada was named so, as he brought waters to the earth. Moreover, the time period of Nārada's birth and the time of origin of waters according to modern geologists are almost similar, that is, around 3.9 billion years. Thus we can see that our ancients intermingled scientific ideas along with philosophical thoughts and presented them as parables.

CONCLUSION:

From the above ideas one can conclude that, though our ancients did not give importance to science as it did not affect the people as a whole, they were well-versed in this field of science too. If researchers of Sanskrit start to decode our ancient texts from the view point of science we may come across more valuable information.

BIBLIOGRAPHY:

1. *Bhāgavata Purāṇa*, Text with Eng. tr. by C.L. Goswami, Gita Press, Gorakhpur, 1971.
2. *Brahmavaivarta Purāṇa*, Text with Eng. tr. by Sen Rajendranath, The Panini Office, Bhuvanewari Ashram, Bhadurganj, Allahabad, 1920.
3. *Devī Bhāgavatam*, ed. by Ramateja Pandey, Pandita Pustakalaya, Kasi, 1962.
4. *Srimad Valmiki Rāmāyaṇa*, ed. by K. ChinnaSwami Sastrigal and V.H. Subrahmanya Sastri, M.L.J. Press, Madras, 1958.
5. Tripathi, Maya Prasad. *Development of Geographic Knowledge in Ancient India*, Bharatiya Vidya Prakashan, Varanasi, 1969.