FROM NIBIRU TO TIAMAT,
AN ASTRONOMIC SCENARIO
FOR EARLIEST SUMERIAN COSMOLOGY

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Abstract

In this paper we consider the Sumerian tradition of a planet, called Nibiru, claimed to approach Earth every 3600 years. We argue that the real period was actually 20 years and that a close passage of that body near Earth around 9500 BC ended the last Ice Age and the Atlantis civilization. Moreover Earth obtained a satellite of Nibiru, that became our Moon. We discuss ancient statements that Moon was originally looking bigger and brighter than now. Then we argue that Nibiru around 6900 BC ended its existence in a giant impact on Jupiter. Between 9500 and 6900 BC Nibiru probably crossed about 120 times Earth orbit, several times quite close, such close passages being possibly related to the reincarnations of the Indian supreme goddess Shakti. We discuss some consequences of the impact on Jupiter, using also results of Ackerman and of Li, among them: the formation of Venus-Athena, the formation of the asteroid belt, the battle of Jupiter against Giants and Titans, the removal of Mars from a weak tie with Earth, and the displacement of Jupiter from its previous orbit, where the asteroid belt is now located, to the present orbit more distant from Sun.

1. The origin of Moon, an introduction.

Till not many years ago the origin of the Moon was generally related to the origin of Earth, both bodies considered to be produced from the condensation of primordial material, several theories proposing different details of the process. When Moon's rocks were collected via space expeditions, it appeared that the standard scenario was not correct, because the rock composition of Moon was too different from Earth's. Moreover many rocks had a different isotopic composition, a fact today unexplainable in terms of known physical and chemical processes. Therefore other approaches were considered:

- Capture of the Moon as a body originating in other parts of the solar systems or of the galaxy. Three body capture is known to be impossible in a pure gravitational framework, but would be possible e.g. for a body braked by an extensive atmosphere around Earth, beyond the only ten km of today. The analysis under braking conditions was performed by Japanese astronomers, see e.g. Nakazawa et al (1983), who found that capture in such a case is possible. Surprisingly they found that the orbit of the body would become circular in less than twenty years. This is another example of unexpected fast processes that show up in astronomy. See in particular Meyer et al (2002), who established that a giant gas planet may form from a torus of gas and dust not in the previously estimated ten million years, but just in... about a century! The problem with this scenario is that there is no evidence of Earth possessing such an extensive atmosphere even in remote past
- The second theory, which has become the standard one, is that, some billions years ago, Earth was tangentially impacted by a body of mass about the mass of Mars, i.e. about ten percent of our planet mass. The impact would have vaporized part of our planet together with the impacting body. Some of the vaporized material would have remained in orbit around Earth. Then by coalescing it would have formed our satellite, whose mass is about ten percent of the mass of Mars. This theory, see Palme (2004), hinges on sophisticated modeling under several assumptions, and cannot be considered as firmly established.

Another theory is capture of the Moon in a 4 or 5 body framework, where it is dynamically possible. There are presently two such theories. One is due to the geologists Ticleanu et al (2011), and was presented at the Santorini Atlantis conference of 2011. They assume capture about 40.000 BC, when there is evidence of a large perturbation of the precession movement of Earth. My theory was also presented in a preliminary way at that conference, and both communications were voted as the two most interesting at the conference. Here I recall the main reasons and features of my theory. Then I refine it using astronomic information made available later and I extend it to a new explanation of the mysterious Sumerian cosmologic story of Tiamat. As a bonus we get a new theory for the formation of the asteroid belt, new information on Mars, confirmation of the mythological story of the birth of Venus from Jupiter, and why Jupiter was the king of the planetary gods. A number of important non trivial research problems to be addressed by mathematical modeling follows from our approach.

2. Capture of Moon from Pachamacac-Nibiru-Metis and later events

Our approach has two main features:

- It assumes capture of the Moon within human memory, actually around 9450 BC; notice that there are many arguments about human memory reaching to that time or even beyond
- At that time Earth had another satellite, orbiting at about one million km distance, that can be identified with Mars; it was inside Hill's sphere, where Earth gravity dominates over Sun's, a sphere having a radius of about 1.5 million km
- The Moon was captured within a four (or five) body event, from a large body P passing sufficiently close (but outside Earth's Roche limit, which is a sphere of about 15.000 km diameter); the body should be identified with the god Pachacamac of Chimu and Incas, Nibiru of Sumerians, Metis of Greeks, possibly Shakti of Hinduism
- The Moon was initially probably closer to Earth than now, so that Sun's disk appeared to be only two thirds large than Moon's
- The Moon capture moved Mars to a more far away orbit, while still remaining bound gravitationally to Earth, hence within Hill's sphere
- The body P had an orbital period of 20 years. After Moon's loss it may have crossed Earth's orbit about 120 times, coming sometimes quite close, but not as close as when it lost its satellite; such close passages were probably in number of ten and may relate to the reincarnations of the Hindu goddess Shakti
- The body intersected Jupiter orbit, then closer to Sun then now, until about 6900 BC it impacted Jupiter itself, providing the most stupendous celestial event in human memory
- The impact reduced substantially the mass of the core of Jupiter and led to several important astronomic events, that we discuss qualitatively, most important the birth of Venus (Athena), the removal of Mars from its weak tie with Earth and the formation of the asteroid belt
- Jupiter was removed to the present orbit, losing the special qualities that made it the king of the planets and of the gods. From a body well visible as a small disk, it became the present point-like star.

In next section we discuss the capture scenario of Moon, in the following section the events relating to the impact of body P on Jupiter.

3. The capture of the Moon from body P

Our proposal is that Moon's origin lies in the capture by Earth of a satellite from a body P passing nearby. The body may have come from the Kuiper or Oort regions, from the space between the two

said regions, rich of bodies of size between Earth and Jupiter according to Dogon and Fargion (1998), or from outside the solar system, where similar bodies are known to exist in the form of brown or red dwarfs or... The satellite entered Earth's Hill sphere, where Earth gravity dominates over solar gravity, and was captured by our planet. The event took place most probably about 9450 BC, the time when Ice Age ended abruptly and the Atlantis civilization was terminated, see Spedicato (2007a,b; 2010). The end of Ice Age was actually due to the close passage of body P, that due to gravitation tidal effects deformed Earth. The oceanic crust was broken along thousand of kim of fault lines, large amount of magma was emitted producing warm rains that melted the ices and increased the world temperature; see Spedicato (2010). In terms of celestial mechanics the capture can be considered in a four body frame (Sun, Earth, body P, captured satellite; disregarding the probably small effects due to Mars as a previous Earth satellite). In this case capture is possible in a pure gravitational context, contrary to the case of the three body event. Here I must thank the late great astronomer Tom Van Flandern, who first considered in a four body event the probable capture of Charon by Pluto from Neptune. Capture requires fine modeling of the parameters relating to the closest distance of P to Earth and the position of the satellite at the moment of the closest passage of P. A problem that can be modeled by suitable choice of the initial parameters of P and its satellite on their approach to Earth. The mathematical modeling implies should use accurate ODE solvers (best would be the Brugnano-Trigiante solvers...) and nonlinear optimization.

In qualitative terms, we conjecture that capture took place when, on the closest approach of P, one of its satellites was located so that Earth was between that satellite and P. Thus Earth was closer to the satellite and we assume that it was gravitationally dominating. Then P moved away having lost that satellite. The initial orbit of what had become our Moon was certainly not circular, but from the quoted Japanese results we can guess that circularization was fast, taking perhaps less than a century. The initial orbit of the Moon was probably also closer, moving to the present distance only after the Biblical Flood (to be dated at 3161 BC on arguments to be given elsewhere). Indeed in Velikovsky unpublished work *In the beginning*, see references, it is recalled that according to Sumerian astronomical tablets the Moon, called Nannar by Sumerians, loomed in the sky greater than Sun, whose apparent size was only two thirds of Moon's. Since now Moon and Sun have almost the same angular size, and there are no reasons to think that Sun's size was different at Sumerian times, than it follows that Moon's distance to Earth was 2/3 of today's. Now today Moon's distance varies between 356.000 and 406.700 km, implying an average value of 384.400 km. Two thirds of this value is about 256.200 km. Presently Moon has a period of about 27.3 days, or 29.5 from the point of view of a terrestrial observer setting on our moving planet, which increases the time for Moon to reach the zenith of a certain Earth point. Kepler third law states that, at first order, the ratio of the square of the major orbital semiaxis (the radius of the orbit if it is circular) to the cube of the period is constant. This law implies that closer bodies move faster. Applying such a law to a Moon at two thirds the present distance we get a lunar period slightly less than 21 days, against the present 27.3. This would mean a number of months of about 16.... And we here recall the special value of 16 in Hindu traditions, 16 being the age considered the best for youth and beauty of humans, and the age at which the Hindu god statues are represented, see Daniélou. The transition of a year with 16 months to the present one is certainly a topic deserving investigation, the transition being almost certainly related to the catastrophic events that affected our planet even after the end of Ice Age. The two main such events are probably the 6900 BC multiple impact on earth of masses coming from Jupiter, see later on, and the event known as the

Biblical Flood, having a complex explanation that I will propose in a following paper. We recall anyway the finding by archaeologist Giuseppe Brunod, private communication, that Val Camonica petroglyphs show that in the fourth millennium BC the year had not 12, but 13 months. This change may relate to the event known as the Biblical Flood, to be dated at 3161 BC, where our explanation is complex and will be given elsewhere. We just say that it would explain the following statement in Plutarch: *Hermes took away one seventieth of the light of the Moon and gave it to Earth, whose year passed from 360 to 365 days*... So, before the Flood, Moon was closer and gave more light, the year had 360 days...

The Moon's capture appears to have been memorized in several traditions found among the Greek scholars, in India, in Southern America, in tribal people and so on. For a partial list see Spedicato (2011b) and Velikovsky's book *In the beginning*, available in the Jan Sammer website dedicated to him. Here we only recall three traditions:

- For the Chimu of coastal Peru, the Moon had a father, Pachacamac
- For the Hindu the Moon appeared after the sea boiled
- For the Malekula of Melanesia the atmosphere filled with vapor, so that nothing could be seen. When vapors disappeared, much land had been covered by the sea and in the sky there was a new body, the Moon.

We notice here how well the Malekula tradition describes the expected effects of the passage of P: the breaking of the ocean crust due to its gravitational tide, the following emission of magma, the pouring of immense warm rains, clouds covering much of the Earth (with increase of temperature and rapid melting of the ices). When clouds dissolved, Moon appeared in the sky.

An important point is that before the capture of the Moon our planed had to have another satellite. One reason is the existence of certain sedimentary structures, found especially along the eastern coasts of Australia, that are called *varves* and that form at each cycle of the Moon. They existed, it seems, before the end of Ice Age, hence Earth had to have another satellite. Other arguments also support the presence of an Earth satellite before capture of the Moon.

The candidate for the previous satellite, which most probably was not immediately removed as an Earth satellite after the capture of the Moon, is Mars. If we are correct that Mars was an original satellite of Earth, then Mars was in the habitable zone, with water and most probably life. Support to this hypothesis comes from its similar rock composition, rate of rotation and angle over the ecliptic plane, the last two facts pointing to a long relation with Earth, resulting in resonance phenomena. That Mars had water till not long ago follows from recent explorations, see Piccaluga (2006) or Ginenthal (2002). Mars water was lost to much extent in one or more catastrophic events, the last one, not to be discussed here, being related to the Biblical Flood. For the idea of Mars having been an Earth satellite I am indebted to independent scholar Matteo Fagone, a contributor to *PianetaMarte.net*.

For long time I wondered about the distance of Mars from Earth before capture of the Moon. A solution appears in a passage in Censorinus book *De die natali*, where this Roman scholar of the third century AD writes: *the Arcadians claim, but I do not believe, that before the Moon existed the year had not twelve but three months.* Notice that the Arcadians, living in an elevated and rugged region of Peloponnesus protected on the north by the Erymanthus range, reaching about 2400 m,

were considered to be the people living in Greece since the oldest times, hence the repositories of the oldest traditions. Now we can interpret Censorinus information as about a previous satellite of Earth, performing not twelve but three cycles per year. Hence it was moving slower, being on a more distant orbit; from Kepler's third law we can estimate such a distance at about one million km, with respect to the present average distance of about 380.000 km of the Moon, hence well inside the Hill sphere. If this satellite was indeed Mars, then at that distance it would look smaller and be less luminous than Moon, albeit the difference would not be great. But if Moon originally was closer to Earth, implying a number of months greater than twelve, then the superiority of the new satellite would have been quite great in terms of apparent size and luminosity.

Mars now is not attached gravitationally to Earth, so some event in our scenario must have led to its removal from the Earth tie. It could have been removed by the gravitational pull of body P. However if, at its closest passage, P was facing the side of Earth opposite to Mars, it could have remained in the original orbit, or be moved by the gravitational pull of P to a more remote orbit. We think that this was the likely case, on the basis of three arguments:

- Traditions that Earth for a time had two satellites, not to say of astronomic theories for two satellites in early times of Earth
- The Turkish symbol showing a large half Moon which has in its interior a five pointed small star; five points symbolize Mars, as the fifth celestial body from Earth (Moon, Sun, Mercury, Venus, Mars); a six pointed star refers to Jupiter, the king of planets
- The need to explain arrival of salty water on Earth following the Tiamat explosion, that will be considered in next section.

Next a picture of the five pointed star inside a half Moon. This symbol has been adopted by Islam, which took it from the Turkish people, there being documented from times predating Islam.

If our scenario is correct, then Moon was captured about 9450 BC, and Earth had two satellites till about 6900 BC, hence for a period of about 2550 years. In the sky there were two Moons, one large and one small!

One should also notice that Aphrodites was originally the name for Moon and not for Venus, according to Macrobius, *Saturnalia* VVV-1,3. The same conclusion is also reached by De Grazia (2009), via analysis of the Mars love affair with Aphrodites in Homer. We can additionally observe that Aphrodites is not a Greek name, but an oriental one. It could be a hybrid name, composed of the Akkadian word *afar*, meaning *dust, foam,* and *di*, meaning *blue* in zhang zhung, the lingua franca for millennia north of India, and *te-ta*, meaning *great* in Chinese. Hybrid names are quite common in Asia. If our interpretation is correct, then the name would recall the time when Moon appeared in the sky after the vapor, the foam, of the oceans dissipated, at the end of the Ice Age, as the Malekula legend recalls so well.

During that period, body P, say Nibiru, every 20 years crossed or came close to both Earth and Jupiter orbits. During that time there were no Mars and no Venus orbiting on their present orbits. From the orbital period and Kepler's third law, the major semiaxis of Nibiru can be estimated at 7.4 AU, or 1.110 billion km, hence less than the major semiaxis of Saturn, which is 1.426 billion km. Hence Nibiru did not cross Saturn's orbit. The calculation of the minor semiaxis, equivalent to the eccentricity, is yet to be done. If we assume that Nibiru passed close to Earth so that it lost a satellite, eccentricity had to be quite significant, implying stability problems, hence a life expected to be not long (thanks to astronomer Adriano Gaspani of Brera observatory for this observation).

When Nibiru crossed Earth orbit, usually nothing happened, Earth being quite far away at that moment. But some of the about 120 crossings that probably took place must have taken Nibiru quite close to Earth, with destructive effects, albeit not as dramatic as when Moon was captured. Such passages were certainly terrifying to human people, then existing in very small numbers after the great catastrophe of the end of Ice Age. Here we hypothesize that they may explain the reincarnations of Shakti, the top goddess in the Hindu pantheon, see Alexandra David Néel, who was introduced to the most secret rituals of Hinduism; she asked who was the God of the Gods, and Shakti was the answer she got.

Shakti is a goddess with a number of properties. She is associated to the greatest energy, she is, with Parvati, one of the main wives of the great god Shiva. Her reincarnations are represented in terms of terrifying goddesses, with colliers of skulls as Kali, or as Durga, who is headless, keeping her head by gripping its hair with a hand.... Goddesses as Kali, Durga, Saraswati, Lakshmi, ... A memory of the terrifying passage of Nibiru? Was Shakti the Hindu equivalent of Nibiru, Metis, Pachacamac?

4. End of Nibiru, explosion of Tiamat, birth of Venus, Mars leaving Earth

People interested in Nibiru have not realized that the period of 3600 years in Sumerian texts is not the real one, due to a multiplication by 180 quite common in Asian chronologies, see Spedicato (2011a). So they are still waiting for a new passage of Nibiru and often identify Nibiru with the so called Planet X, introduced by astronomers to explain certain perturbations of bodies in the solar system, but never found. In our scenario, Nibiru not only had no period of 3600 years, so great that no human could associate its arrival to a passage of 3600 years before..., but it does not exist any more. The reason is that Nibiru, the Metis of Greek mythology, ended its life in the way that is beautifully described e.g. for Metis, see e.g. Hesiodus 890, Apollodorus 7,3 and Hyginus: *Metis, pregnant of Athena, entered the body of Jupiter and Athena was expelled from Jupiter's head.*

An interesting detail of the Metis myth is that when she entered Jupiter body she was five months pregnant by Jupiter, of whom she was a wife, which may be explained by a previous passage close to Jupiter that deformed Metis. We also note that Athena and Venus are to be considered the same body, since the identification of the star of the morning with the star of the evening took place by Greek astronomers late in the first millennium BC. Below we will analyze the statement of Metis entering Jupiter at the light of very recent and quite unexpected astronomic findings.

In the Sumerian cosmology the event that in our opinion corresponds to the Metis story, albeit is much more rich of details, is the story of the planet-god Tiamat. Here we give only some basic features of the story, to be developed in further releases. The scenario presented here is indeed a very recent finding. It follows from information in a book by Scranton (2012) and suddenly appeared to my mind when reading the book by Leick (2006) on lost cities of Mesopotamia.

We cite the following events related to the giant goddess Tiamat, more info on Tiamat to be considered in further releases:

- it opened as a shell
- it spread its entrails into space
- it left a trail of luminous pearls, sometimes associated to a milky way
- it splashed Earth with salty water

The above dramatic and apparently phantasy events can be explained by the following scenario, involving our body P, i.e. the considered god-planets Pachacamac, Nibiru, Metis (also Shakti?):

- P impacted Jupiter at high speed, high energy, having itself a large mass, and a speed several dozen km per hour, see below
- It entered the body of Jupiter, see below for Ackerman theory on the composition of Jupiter; the impact point was where the red spot now lies, pointing to a huge and deep crater, possibly thousands of km deep; hot gases are still gushing from there
- A very large amount of Jupiter mass was expelled due to the impact, of order the mass of the impacting body, say several times the Earth mass

- Some of the impacting material orbited Jupiter, seen from Earth as the Giants and Titans fighting against Jupiter; some of it later may have coalesced forming new satellites of Jupiter;
- Some of the material, not a large mass, presently less than lunar mass (no more than 2% of Earth mass), remained in Jupiter original orbit, forming what is the present asteroid belt; the material was initially very hot, thereby appearing as chain of luminous pearls
- Chunks of different size were expelled to long distances in the solar system, presumably within a certain cone of emission. Most of them probably ended in the Sun. Part of them reached Earth, and may be identified with the seven large objects that at the same time, about 7000 BC, hit Earth, both on continents and on oceans, as claimed by Tollman A. & E. (1993). Notice that the Koefels crater in the Alps is dated at that time, see Combes (2007). If Mars was still an Earth satellite, but revolving quite far away and hence weakly gravitationally tied to Earth, then having a surface about on fourth of Earth, it may have been hit by two, or more, or less, masses similar in mass as those that hit Earth. We conjecture that it was hit by a rather big chunk, that left the huge depression corresponding to a bulge of its opposite side, a well known and unexplained feature of Mars. The impact may have removed Mars from its gravitational tie with Earth. Moreover if Mars still had oceans, part of their water might have been projected into space and might have reached Earth, explaining the Tiamat story of arrival of salty waters. Such waters were noticed of course when they reached the interior of continents, especially of deserts, where they may have formed some of the many salty lakes found there. According to Sumerian sources such salty waters in particular mixed with the sweet waters of Apsu. Apsu can be identified with the present deserts of Takla Makan and Lop Nor, that some thousand years ago were covered by sweet water. This water originated from the melting of the ices in the Tibetan plateau, Tienshan, Nanshan etc, around 9450 BC, as established by geomorphologist Eröl Orguz. There are arguments that the Sumerian pre-Flood cities, like Eridu, were built in this region, the Sumerian moving to Mesopotamia after the Flood, see Spedicato (2012). Also some material might have reached Moon, displacing it to a more distant orbit, corresponding to a number of months less than the initial sixteen.

The above scenario implies that Jupiter orbit was where is now the asteroid belt, between present orbits of Mars and Jupiter. So Jupiter was, under such a scenario, at a closest distance from Earth of 1.3 AU, i.e. about 200 million km, since the asteroid belt has an elliptic structure, whose minimum distance to Sun is 2.3 AU. Presently Jupiter is at 5.2 AU from Sun, hence at closest 4.2 AU from Earth, i.e. about 630 million km. Venus now is at 0.7 AU from Sun, hence 0.3 AU from Earth at closest distance, i.e. 45 million km. Now Venus is the most brilliant planet in the sky and at closest distant appears as a small disk, as I saw at naked eyes when the sky was very clear at the South Balkan Observatory in Bulgaria. Jupiter when in the orbit associated to the asteroid belt, if our data are correct also for that time, would therefore have appeared about four times smaller due to distance with respect to Venus, but about 12 times larger for its diameter is about 144.000 km (possibly it was larger before the impact!) against about 12.000 for Venus. So Jupiter appeared 3 times greater than Venus at their closest approach. This means that Jupiter looked in the sky not as a point, but as a disk, of angular size about one tenth of present lunar size.

When Jupiter was impacted, then the heat from the impact must have expanded its atmosphere greatly, probably giving it an apparent size in the sky greater than the size of the Moon. The heat was slowly lost, while Jupiter moved till the present position, where it is quite difficult to recognize it as the king of the planets. While Jupiter was so expanded, certainly giant lighting phenomena took place, also visible from Earth. The famous lightings of Jupiter??!!

The fight of the Giants and the Titans can be interpreted in terms of the very hot material expelled that orbited Jupiter. Point-like lights were seen exiting from Jupiter and then reentering it. It is not clear how to explain the help that Jupiter got from Athena, as shown in the Panathenaic festival in Athens, see Celsus, *Contra Christianos*. Maybe she was expelled not immediately, but after the minor chunks which orbited Jupiter, and its expulsion partly dispersed them. Notice that analysis of the evolution of Venus-Athena down to the present state has been done in two major monographs by physicist Ackerman (1999a,b), who made great use of Vedic texts, to be dated at least at the fourth millennium BC, according to Subhash Kak, a scientist from the royal Kashmiri family. About the Giants, the *Theogony* of Hesiod, verse 636, states that their war with Jupiter lasted ten years. This may mean that after such a time the bodies associated with the Giants became invisible, both due to their cooling and to the increased distance of Jupiter moving to another orbit.

The above scenario is supported by the discovery from probe measurements of the interior masses of Jupiter and Saturn. It has been found that Jupiter core mass is remarkably smaller than Saturn's, by a factor two possibly, a finding that cannot be reconciled with existing theory, unless some mass of Jupiter was lost in a giant impact. See Scranton (2012), who quotes an article in *New Scientist* by D. Shiga (2010), and the subsequent analysis by Chinese astrophysicist Li Shulin, of Peking University, who estimated the mass of the impacting body in ten Earth masses. See also the more recent paper by *New Scientist* editor Maggie Mc Kee, December 2011, who as an alternative presents more exoteric theories as the slow dissolving of the Jupiter core. Of course it will take time to the standard astronomy world to accepts that such dramatic events took place in solar system at human memory, to be kept within mythology, traditions and religions.

Now, the important question of the dating of the event. In the Tollmans book a date of about 7000 BC is given for their considered simultaneous impacts of seven large objects on Earth. It is also known that varves, special marine sediments, indicate a breaking of the arctic ice cover around that period, see Bibby (1960). A little known statement in Ixtilochitl, a historian of Spanish father and Aztec mother, given in Gilbert and Cotterell (2006), reports from a lost Toltec code that Venus was born 1.366.560 days from the beginning of the Mayan chronology, considered to be year 3114 BC (the year implying that the long computation should end in December 2012, so that someone is thinking of the end of the world...). Assuming a duration of the year of 360 days, back counting from 3114 would then give for the birth of Venus a date of about 6900 BC, well in agreement with Tollmans geologic and paleontological dating. It is quite surprising that this precise Toltec statement has apparently escaped the attention of scholars, including in particular the people that accepted a real birth of Venus from Jupiter on the arguments given by Velikovsky. Let us here just notice that the period between end of Ice Age and 6900 BC was a dark period for mankind. People had to be very scared of the celestial events and may for this reason have built the subterranean cities found e.g. in Anatolia. Then mankind slowly recovered, and the great period of Neolithic development started...

Something yet to be studied is the effect of the impact on the orbit of Jupiter. The impact was probably frontal in view of the resulted effects. Reasons of momentum conservation plus the jet effects of the impact and the loss of part of Jupiter mass would certainly decrease of orbital speed of Jupiter. Therefore on the basis of Kepler's third law Jupiter moved to a more distant orbit, ending in the present one... a problem whose analysis is very complex, since mechanics effects have to be coupled with thermodynamic effects, not to say of possible electromagnetic effects.

Finally, an intriguing question. When Jupiter reached its present orbit, was it empty? We have in mind Titus-Bode law, a consequence of the macro quantization studied by, inter alia, Vladimir Damgov (2004). Was Saturn there? Did Jupiter interact with Saturn?

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