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Does the myth of Phaethon reflect an impact? Revising the fall of Phaethon and considering a possible relation to the Chiemgau Impact

Barbara and Michael Rappenglück[1]

Bahnhofstrasse 1, 82205 Gilching Germany
(Barbara.Ruppenglueck@evtheol.uni-muenchen.de)

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Abstract

In Greek mythology there exists one story that has repeatedly been interpreted to describe the fall of a celestial body: the story of Phaethon, who undertakes a disastrous drive with the sun-chariot of his father Helios. First, the article presents the arguments given by ancient authors for interpreting this story as the reflection of a natural phenomenon. Then details given in the old descriptions of Phaethon's fall are compared with nowadays knowledge of impact phenomena. Furthermore the texts are examined for clues to the time and the location of the hypothesised impact. These considerations substantiate the suggestion that the myth of Phaethon reflects a concrete strike of a meteorite, the so-called Chiemgau Impact. That impact struck the south-east of Bavaria/Germany at some time during the Celtic period and left an extended crater-strewnfield of about 100 craters. A conspicuous intersection between the tradition of the Phaethon-story and the up to now known time-frame for the Chiemgau Impact gives new clues for dating the Chiemgau Impact to the time between 600 and 428 BC.

Keywords: *Phaethon, Chiemgau Impact, myth, meteorite, Celts*

The myth of Phaethon

During antiquity the myth of Phaethon has again and again been considered to describe the fall of a celestial body. This article will substantiate this interpretation by combining it with phenomena observed in connection with meteorite impacts. Furthermore, it will present the hypothesis, that the myth of Phaethon reflects a concrete strike of a meteorite, the so-called Chiemgau Impact, an impact that struck the south-east of Germany at some time during the Celtic period.

1(for the Chiemgau Impact Research Team: Prof. Dr. Kord Ernstson, Ass. Prof. Dr. Ulrich Schüssler [both University of Würzburg], Dr. Michael Rappenglück M.A., Barbara Rappenglück M.A. [both INFIS, Gilching], Rudi Beer, Gerhard Benske, Hans-Peter Matheisl, Werner Mayer, Till Ernstson, Ernst Neugebauer, Ralph Sporn)

Basic outlines and first evidence

The main features of the Phaethon-myth are the following ones: Phaethon, the son of Helios, borrows the sun-chariot of his father. But he is not able to keep course along the sun's accustomed path and the un-oriented, burning chariot sets parts of heaven and earth on fire. To prevent an even bigger catastrophe, Zeus strikes Phaethon by his thunderbolt and the youth falls to earth into the river Eridanos. Phaethon's sisters, the Heliades, while mourning their dead brother are transformed into poplars and their tears become amber.

The first assured confirmation of the story of Phaethon riding the sun-chariot is given in two plays of Euripides, the fragmentary "Phaethon" and the fully-preserved "Hippolytos", that had been performed in 428 BC. Very probably the story of Phaethon had been mentioned already earlier in Aischylos' play "Heliades", that is supposed having been written between 468 and 456 BC (Blomqvist 1994, 6). All considerations of an earlier occurrence, e.g. in the works of Hesiod, remain hypothetically (see the discussion Diggle 1970, 4f., 10-15, 23f.; Blomqvist 1994, 6f.; Csaki 1995, 8-20).

The Phaethon-myth as the reflection of a natural phenomenon

The idea of the Phaethon-story being the portrayal of a cosmic event occurred already to classical authors. Plato in his "Timaeus" (22c-d) interpreted a shifting of the celestial bodies to be the true background of the story of Phaethon. This notion was concretised by Aristotle (*Meteorologica* I,8a). He refers to a Pythagorean tradition claiming that the Milky Way came into existence by the fall of Phaethon. In the 1st century AD Manilius (*Astronomica* I,735-749) as well as Diodorus of Sicily (*The Library of History* V,23,2-4) resumed the idea of the Milky Way being a relict of Phaethon's straying course, both rejecting it as fancy. But even in their refusing position they give a testimony for the still existing idea. The Pseudo-Aristotelian scripture "On the cosmos" (ca. 1st/2nd cent. AD; 6,400a,30-32) in contrast to these authors takes the fall of Phaethon for granted as a natural event, quoting it among several kinds of natural catastrophes like volcano eruptions and tsunamis. Valerius Flaccus (*Argonautica* V,429-432) simply described Phaethon as a "black" or "black-smouldering" "globe" that fell into the river. Another author giving the priority to a nature-based interpretation of the Phaethon-myth was Philostratus (*Imagines* I,11): *"...wise men interpret the story as indicating a superabundance of the fiery element in nature..."*. Proclus considered Phaethon as a comet: *"...it is supposed that this Phaethon was a comet, which being dissolved produced an intolerable dryness from vehement heat. ...The disappearance likewise of the comet, is said to be the destruction by thunder."* (*Commentary on the Timaeus of Plato*, 1,109,34A/B) Proclus' interpretation was agreed to by Olympiodorus (*Olympiodori in Aristotelis Meteora Commentaria* I,8 [p. 66/67]) as well as Ioannis Malalae. He additionally rejected the story of Phaethon as a fable and claimed to know its true background, namely that a fireball struck the country of the Celts and fell down into the Eridanos (*Chronographia*, *Logos protos* 3).

All these cited authors give evidence that the idea of Phaethon reflecting the fall of "a star", a meteorite or comet was present all over the centuries of antiquity. Within the last decades, a number of researchers tried to identify the story of Phaethon with an assumed strike of a meteorite at a certain location and a certain time (Kugler 1927; Spanuth 1965, 160-190; Kobres 1993; Bischoff 2003; Papamarinopoulos 2005 etc.). Most of these publications assume an impact around 1200 BC. The suggested locations of the event vary: Helgoland, the Po-Delta, or the Mediterranean Sea. Several problems are characteristic of these works: *1st.* The location of the fall is hypothetical, because at the suggested locations neither a crater nor any other evidence of an impact can be provided, *2nd.* The time of the fall is hypothetical: No attention is paid to the question when the Phaethon myth had been formed. Furthermore, the myth of Phaethon is arbitrarily mixed up with other myths which are all, a) uncertain whether dealing with the strike of a comet at all, b) undated, and,

c) derive from different cultures. This mixture of myths is then, d) deliberately combined with remarkable dates of cultural history and thus the date of the suggested impact is gained. By the strength of their argumentation positively outstanding from these works are the articles of Wolf von Engelhardt (1979) and Jerker Blomqvist (1994). Remarkably, Blomqvist is the single one, who suggests a connection between the myth of Phaethon and actually existing craters, the Kaali craters in Estonia.

The comparison of nowadays knowledge of impact phenomena with details given in the old descriptions of Phaethon's fall will substantiate the long-lasting tradition of interpreting the fall of Phaethon as the fall of a meteorite.

Some hints on the trajectory of the "Phaethon"-object

Some passages in the Greek and Latin texts dealing with the myth of Phaethon give information about the trajectory of the proposed meteoroid. In this context it is very important to keep in mind that the authors tried to outline a complete sequence of Phaethon's movement. They didn't present a single and simple 'snapshot' of the event, but different views summed up in one narration.

Phaethon started his course with the sun-chariot in the morning. It seems that the authors thus described a certain kind of celestial body, which stayed close to the sun at the time of sunrise. Phaethon rose together with the sun at the eastern horizon, outshined by it. For some time the celestial body, which was moving quickly, took the same orbit as usually the sun did. But then it left the solar track exceeding the limits of the zodiac and went its own irregular, rolling way (Nonnos 38,307-411). This is the description of the body's movement at the day of the impact. In addition, the authors describe Phaethon's wild ride, which caused great chaos in the cosmos, in particular among the constellations and planets. Of cause this view isn't possible at daylight. Therefore it is very likely that the writers included different reports of the unusual orbit, which a brilliant comet had taken among the constellations, appearing some time before the Phaethon-event happened. The nightly course of this object and Phaethon's single daylight movement together with the rising sun until the "airburst" were intermingled (Ovid, *Metamorphoses* II,156-324; Nonnos 38,307-411; Diggle 1970, 190).

The daylight movement at the day of the impact looked like an object coming out of the direction of the sun, growing rapidly bigger and increasing quickly its luminosity and finally drifting away from the seeming course of the sun. Then there was a big explosion, which broke the object up into several parts. Graeco-Roman writers put the whole process into metaphors, saying that Phaethon was hit by a lightning-stroke and/or a thunderbolt, which Zeus/Jupiter had thrown against him to stop the disastrous ride (Plato 22c; Apollonios Rhodios, *The Argonautica* IV,597-599; Lucretius, *On the nature of things* 400f.; Ovid II,311-313, Pliny the Elder, *Natural history* XXXVII 31; Ps.-Aristoteles, *On marvellous things heard* 81; Diodorus of Sicily V,23,3; Hyginus, *Fabulae* 152A, 154; Nonnos 38,410f.; Proclus 1,109,34A/B, 1,110,34C), and that Phaethon lost the control of the Sun's chariot and fell out of the vehicle.

The ancient authors tell us some details about the passage of the object through the atmosphere: They stated that Phaethon fell down "head first": That is an interesting hint on an asymmetrical light phenomenon and would fit very well to the division of a meteor into a "head" and a "trail". Furthermore they described a special movement of the solid body on its way through the atmosphere: It was staggering, rolling, moving up and down, and turning head over heels (Ovid II,165-166, 206-207, 320; Aetius Arabus III,1,2; Nonnos 38,410f.). Details are given that describe the appearance of the object: Phaethon's "hair" was on fire and burning reddish (Ovid II,319; Philostratos, *Imagines* I,11,2). His "breast was smouldering with the heat" (Philostratos I,11,2). In addition the object is said to be a "fiery sphere" (Ioannes Malalae, *Chronographia, Logos protos* 3). Seemingly the writers

wanted to describe the ball of superheated air around the nucleus of solid material and the trail of hot ionized atmospheric gases behind the fireball (Norton 2002, 35), using the terms "sphere" and "hair". The red colour can be diagnostic for specific elements, vaporized and ionized in the fireball. Oxygen gives a red, Calcium an orange-red colour, for example (Norton 2002, 35f.).

Furthermore the writers describe Phaethon's face as "smoking" and his body as being blackened by the lightning stroke (Ovid II,324-326) or as a big "black sphere" (Flaccus V, 430). In addition it is said that Phaethon hasn't anymore a free field of vision to drive the chariot, because of the pitch-dark veil, in which he was wrapped (Ovid II,231-234). This is quite well understandable: On its hypersonic (entry velocity from 12 to 72 km/s; Mach number > 5) passage through the atmosphere the front part of the solid body is heated up rapidly by shock compression of the air. At temperatures about 1500° C ablating of material starts in a standoff zone of tempered air between the object's front side and the bow shock. Minute droplets are formed and driven away by the hypersonic flow around the body into the vacuum at its backside. There the matter quickly cools down into solid spherules, which set up a big dark dust trail (Norton 2002, 35).

Cascading fragmentation

Not only did Phaethon fall from the chariot of Helios, but according to some authors the vehicle itself was completely dismantled (Ovid II,316-318; Manilius I,746; Flaccus V, 429-432; Engelhardt 1979, 11 Abb. 1). This narration illustrates very well the airburst of a bigger meteoroid and the following cascading fragmentation at a certain altitude.

Other authors (Lucretius V,404; Diodorus of Sicily V,23,3; Nonnos 38,413-414) delivered that the chariot of the Sun remained intact. Both views are very well understandable: The explosion and fragmentation of the meteoroid happened close to the sun. So the impression was that the chariot of the Sun itself had been disrupted. But after the big airburst accompanied and followed by certain atmospheric phenomena had gone the sun was moving along her usual orbit as everyday. Thus the celestial vehicle somehow must have remained intact.

Fallout phenomena

The dust material set free by the airburst and several impacting pieces on the ground darkened the whole sky. The Graeco-Roman authors report that as a consequence of Phaethon's nose-dive an ash rain occurred, which covered the world (Ovid II,231-234, 283f.; Statius, *Thebaid* 1,219-221). In addition the burning of the vegetation caused powerful fires with big clouds of smoke at several places (Ovid II,331f.; Nonnos 38,418). Thus it is very well understandable why ancient authors said that the sun didn't shine for one day after Phaethon's fall (Ovid II,329-331; see Engelhardt 1979, 179). The writers agree that the original natural order was quickly restored (Ovid II,401-408; Nonnos 38, 416-423; see Engelhardt 1979, 191). This statement indicates that the impact wasn't strong enough to cause a global darkness, but nevertheless regional obscurity.

The enrichment of the atmosphere with dust grains could have caused local heavy rain and subsequent strong flooding of rivers and lakes, which is noted down by Graeco-Roman writers (Hyginus 152; Blomqvist 1994, 5). The strong rain extinguished quickly the wide-spreading fires (Nonnos 38, 416-420). It is postulated that big bodies passing through the atmosphere produce nitrous and nitric acid rain from the nitrogen in the air. This fact may support the statements of ancient authors that 'poisonous vapors' had been set free by the fall of Phaethon or that toxic gas exhaled from the lake, in which he crashed (Apollonios Rhodios IV, 599-600; Ps.-Aristotle 81).

So the descriptions of Phaethon's fall handed down by Graeco-Roman authors gives a pretty accurate description of a big piece of matter on its passage through the atmosphere. But: When and where did the hypothesised impact happen?

When did the hypothesised impact happen?

Since the motive of Phaethon the sun-charioteer

definitely existed since 428 BC, and probably even earlier since 468-456 BC, we do have a date ante quem for the event. Does there also exist a date post quem? Blomqvist concluded from the tradition of the motive of the sun-chariot and from archaeological evidence of the chariot in general, that 2000 BC might give the lower limit (Blomqvist 1994, 9). Apart from these considerations, one of the ancient texts dealing with Phaethon might give some clues: Ovid tells of Phaethon's visit at the heavenly palace of his father Helios. In detail he describes the door (*Metamorphoses* II,18), speaking of twelve signs of the zodiac being evenly distributed in two groups of six on the two wings of the door. In a following passage, in the description of Phaethon's ride along the heaven, Ovid says that Scorpio covers the space that is otherwise occupied by two signs of the zodiac (II,195-197). This information deserves closer attention. The first assured confirmation of the Greek zodiac divided into twelve constellations, including Libra, is given in the 3rd century BC (Gundel 1992, 16f.). Before this time, since the 6th century BC, the Greek zodiac consisted of eleven constellations, with the constellation Scorpio being regarded to extend over the space of today's constellations Scorpio and Libra. Why does Ovid in the description of Phaethon's straying course refer to this old concept? Does he refer to an older depiction of Phaethon's ride that informed about details of the straying celestial body's course on the background of the then actual zodiac? It is strikingly, that the above noticed dates for the first evidence of the Phaethon-story, namely 456/428 BC, are remarkable situated within this time of roughly 600-250 BC. We cautiously consider this consistence as a clue to a possible dating of the impact within the time between 600 and 456/428 BC.

Where did the hypothesised impact happen?

Besides numerous indications for the event being localised in Northern or Western Europe (Blomqvist 1994, 9-14), several ancient authors explicitly said the land of the Celts to be the scene of action: Apollonios Rhodios (IV,611), Plutarch (see Ioannis Malalae, *Chronographia, Logos protos* 3), Pausanias (*Description of Greece*, Attica IV,1), Nonnos and Ioannis Malalae. Nonnos says (*Dionysiaca* 38,93): *"...Phaethon... was swallowed up in the Celtic river..."*, and he stresses, that the story of Phaethon was well known by *"the Celts of the west"* (38,97ff). Ioannis Malalae on his part tells that the story of Phaethon is a Greek reflection of an event that took place in the Celtic country: "In those times God sent a fire-ball down from heaven on the Gigants living in the Celtic country, and he burnt them and the country. And the ball got stuck in the river Eridanos and extinguished. From this fire the Greek tell and the say, that it was the son of Helios, which they call Phaethon, who fell from the chariot to the earth." (*Chronographia, Logos protos* 3)

Summarizing the arguments we have a strong evidence for the fall of Phaethon/the suggested impact having taken place in Northern or Western Europe, specifically in the Celtic sphere of influence. Let us now revisit the suggested time-frame for the impact that is supposed to be reflected in the Phaethon-story: Blomqvist argued for the two millennia BC, while we ourselves consider narrowing down this space of time to about 600-428BC.

Whatever of these two alternatives you choose: when you look around in Northern or Western Europe for the traces of an exploding meteorite within the two millennia BC, than you will have only two candidates – the Kaali impact in Estonia (Island of Saarema; 58° 24' N, 22° 40' E) and the 'Chiemgau Impact' in Germany (Southeast Bavaria). When Blomqvist published his article in 1994, the Chiemgau Impact had not yet been discovered. Therefore it was obvious for him to identify the Phaethon event with the impact, which generated the Kaali crater strewn field. But we consider the Chiemgau Impact to be more probably reflected in the myth of Phaethon. Here we summarize the main results of the research work on the Chiemgau Impact from 2003 to present, which give evidences for our proposition (see for the following CIRT).

The Chiemgau Impact

The Chiemgau strewn field consists of about 80 meteorite craters having diameters between 3 m and 400 m scattered in a large, roughly 60 x 30 km distribution ellipse (about 1,200 km² between 47.8° to 48.4° N and 12.3° to 13.0° E and 362 m to 560 m asl). A certain 'grading' of the hitherto documented craters is striking: the small craters are located predominantly in the northern part, and the larger ones are predominantly accumulated in the southern part of the strewn ellipse. Thus the entry trajectory of the impactor must have had an orientation more or less from northeast to southwest. From preliminary model calculations we have deduced a very low-density object (< 1.3 g/cm³), sized roughly 1100 m and having entered the atmosphere at a velocity of about 12 km/s on a low-oblique (about 7°) trajectory. A first fragmentation occurred at an altitude of 70 km. The modeled scenario applies for a meteoroid that was intact on entering the denser layers of the atmosphere. These considerations and model calculations are preliminary due to the current and so far limited knowledge of the impact field pattern.

In impact research seven criteria are known to identify impact structures. Three of them (1,5,7), each one by itself, are generally accepted as a confirmation for an impact event (Norton 2002, 291-299). The seven criteria are:

1. Shock metamorphosis in rocks and minerals (e.g. planar deformation features [PDF] in shocked minerals, diaplectic glasses, shattercones in rocks):

Our research group has found PDF (in quartz) coming from one crater in the northern part of the strewn field, in rocks from the wall of the biggest crater Lake Tüttensee, and also in stones dug up from an undisturbed layer (0.8 m depth) close to this crater (only 800 m away). Additional PF (planar fractures) and micro-twining in calcite, indicating weaker shock effects, have been detected. Thus one of the criteria necessary to verify an impact is confirmed.

2. Morphology of craters: Crater morphology is clearly ascertained by characteristic deformations of the rocks, magnetometrical exploration in the northern part of the strewn field and a gravity survey of Lake Tüttensee crater.

3. Geophysical anomalies (magnetic, gravimetric): An extensive magnetic anomaly that can be attributed neither to an anthropogenic nor a geogenic origin has been detected in the northern part of the strewn field (Hoffmann et al. 2004). Furthermore, a gravity survey of Lake Tüttensee crater establishes a negative gravity anomaly related mainly with the water but, unexpectedly, also an extended ring of positive anomalies outside the crater structure. It is explained by a model of soil liquefaction and post-liquefaction densification well known from large earthquakes. Here, instead of the earthquake shock, the impact with the propagation of the shock waves and the mass flow behind the shock front was probably responsible of the densification of the porous, extremely water-rich target rocks.

4. Special evidences (e.g. fullerenes, microdiamonds or nanodiamonds [as part of/or result of the impact generated by shock metamorphosis]): Fullerene-like structures and nanodiamonds (1 nm = 10^{-9} m) occur in the melt crust of rocks from a 11 m-diameter crater (Rösler et al. 2005). They are embedded in mm-sized carbon spherules which can be found not only in the Chiemgau strewnfield but in soils widespread over Europe (Rösler et al. 2005), thus suggesting a fallout-phenomenon. Furthermore, titanium carbide, hitherto unknown as a natural terrestrial mineral, and extremely rare ferrosilicides such like gupeiite (Fe_3Si) and xifengite (Fe_5Si_3) have been found in soil layers completely undisturbed by human activities and in the melt crust of stones from one crater. The origin of the ferrosilicides is puzzling: currently, an anthropogenic origin cannot be excluded, but the circumstances of their occurrence are difficult to harmonise with an anthropogenic origin.

5. Detection of meteorite fragments of the impactor or geochemical traces of the impact: Recent analyses of a gupeiite from the Chiemgau crater field reveal a very similar composition in comparison with low-nickel iron suessites of the North Haig ureilitic meteorite and of the NWA 1241 ureilitic meteorite. The iron-nickel silicide mineral suessite is exclusive-

ly known from the occurrence in meteorites.The similar compositions suggest the Chiemgau gupeiite is also a meteoritic mineral, if an anthropogenic origin can definitely be excluded.

6. Geological evidences (impact breccia, breccia dikes, high pressure-short time impact metamorphism, exotic layers in rocks): Cobbles and boulders sampled from different craters, among them the Lake Tüttensee crater with a diameter of roughly 400 m, have been analyzed petrographically and geochemically. They show both the strong mechanical and thermal destructions including shock-metamorphic effects and abundant glass formation clearly pointing to an impact event. Deformations typical of shock-wave passage are multiple sets of planar deformation features. Moreover a crater was detected, where the rocks, throughout the whole rim wall of 20 m diameter, have experienced temperatures exceeding 1,500° C (Hoffmann et al. 2005).

Near Lake Tüttensee, a layer intercalated in Holocene (= post-glaciation) gravels and probably being ejecta of the Tüttensee crater exhibits a complex and peculiar composition. Heavily fragmented (brecciated) rocks originating from Quaternary moraine material are associated with silicate and carbonate pebbles and cobbles that on the one hand show a coating by and impregnation of a dark carbonaceous matter and that, on the other hand, are extremely corroded, in many cases down to a skeletal structure. In the dark coating, graphite has unambiguously been identified. The strong corrosion even of gneiss and granite cobbles that may be squashed by hand is explained by the action of acid, probably nitric-acid precipitation immediately after the impact. Nitric acid is generally assumed to be produced in large quantities in the explosion clouds of bigger impacts by the contribution of atmospheric nitrogen. The hypothesis of an impact acid precipitation is substantiated by the abundant occurrence of fresh magnetite octohedron crystals restricted to this peculiar horizon. Since magnetite resists acids and lyes, the crystals can be interpreted as the residuals of rock dissolution. The origin of the graphite is unclear for the moment. A geologic formation can be excluded suggesting an impact origin.

These results and at least one fulfilled criteria necessary for the confirmation of an impact event, give the evidence that once there was a powerful meteor strike in southeast Bavaria, which was much bigger than the Kaali impact and could have influenced a large area. It should have caused distinct noticeable light, sound, atmospheric, and seismic phenomena, which can be very well compared to those deduced from the Phaethon-event. The striking similarities between both are the course of the object, which indicates that the event happened in the eastern quarter of the sky, a luminosity of the object rivaling the sun, the long trajectory (low entry angle), the big airburst, the explosion cloud of dark (carbonaceous rich) material, the cascading fragmentation of the object, the fallout of acid rain, the location in the Celtic area (those days Bavaria was situated in the core region of the Celtic culture).

A last and very important argument that supports the identification of the Phaethon event with the Chiemgau Impact is finally given by the dating of the latter. A precise dating is so far missing, but there is a good evidence for the impact to have happened in the 1st millenium BC: Two thermoluminescence datings (prompted by Dr. Victor Hoffmann/Tübingen) of crater cobbles coated by a nanodiamond-bearing glass crust revealed an age of 300 B.C. with an uncertainty of several hundred years and of 500-400 B.C. ± 300 years respectively (pers. com. Dr. Bert Raeymaekers/Gendorf). A number of Roman archaeological objects dated 2nd century A.D. were found on the rim wall of Lake Tüttensee crater, testifying that the craters must have been formed before. This is substantiated by a radiocarbon dating of charcoal from a layer in another crater revealing an age of 1,790 ± 60 years B.P. corresponding with the 2nd/3rd century AD (Fehr et al. 2005, 192). Moreover, the impact must have happened before the beginning of the Roman occupation that is before 15 BC, because the Romans in the Chiemgau area would have documented this catastrophic event if they had become eyewitnesses of the impact. The Celtic idea of the collapsing sky, handed down to us since 335 BC, suggests a date

of the impact before that time. Thus a date for the Chiemgau Impact between roughly 800 and 335 B.C. is most probable at this stage. The deduced date for the Phaethon-event between 600 and 456/428 BC is remarkably situated within this time.

7. Observation of an impact event [historical records.

Taking all this into account we favour the Chiemgau Impact to be the very event reflected in the Phaethon myth. Thus criterion (7) might be fulfilled, too.

Conclusions

a) The myth of Phaethon describes the impact of a meteorite.

b) Elements from within the Phaethon-narrations suggest a rough dating of the Phaethon-event within the two millenia BC, and with good probability a more exact one between ca. 600 and 456/428 BC.

c) The Phaethon-event is to localise somewhere in Northern or Western Europe.

d) The concluded time-frame and localisation fits to two known impacts: the Kaali impact and the Chiemgau Impact.

e) The dimension of the Chiemgau Impact and its details suggest the identification of the Phaethon event with the Chiemgau Impact. In this case, the remarkable intersection of the time frames for the Phaethon event and the Chiemgau Impact suggests with a good probability for the latter one a date between 600 and 456/428 BC.

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References

(The texts of Greek and Latin authors, if not mentioned below, refer to the edition of the Loeb Classical Library.)

Bischoff, G. (2003) *Der Sturz des Phaethon* (http://www.efodon.de/html/archiv/vorgeschichte/bischoff/phaeton.htm; 7.5.2006).

Blomqvist, J. (1994) The Fall of Phaethon and the Kaalijärv Meteorite Crater: is there a Connection? *Eranos*, vol. 92, 1-16.

CIRT (Chiemgau Impact Research Team) (2006) *The Chiemgau Impact* (www.chiemgau-impact.com; 7.5.2006).

Csaki, L. C. (1995) *The influence of Ovid's Phaethon*, UMI, Ann Arbor.

Daiber, H. (1980) *Aetius Arabus. Die Vorsokratiker in arabischer Übersetzung*, Steiner, Wiesbaden.

Diggle, J. (1970) *Euripides Phaethon*, University Press, Cambridge.

Engelhardt, W. v. (1979) Phaethons Sturz – ein Naturereignis? *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Math.-naturw. Klassse*, 161-199.

Fehr, K. T./Pohl, J./Mayer, W./Hochleitner, R./Fassbinder, J./Geiss, E./Kerscher, H. (2005) A meteorite impact crater field in eastern Bavaria? A preliminary report. *Meteoritics & Planetary Science*, vol. 40, 187-194.

Gundel, H. G. (1992) *Zodiakos. Tierkreisbilder im Altertum: Kosmische Bezüge und Jenseitsvorstellungen im antiken Alltagsleben*, Philipp von Zabern, Mainz.

Hoffmann, V./Rösler, W./Patzelt, A./Raeymaekers, B./Van Espen, P. (2005) *Characterization of a small crater-like structure in SE Bavaria, Germany* (http://www.lpi.usra.edu/meetings/metsoc2005/pdf/5158.pdf; 7.5.2006).

Hoffmann, V., Rösler, W. and Schibler, L. (2004) Anomalous magnetic signature in top soils in Burghausen are, SE Germany. *Geophysical Research Abstracts*, vol. 6, 05041.

Kobres, B. (1993) *Comet Phaethon's Ride* (http://abob.libs.uga.edu/bobk/phaeth.html; 7.5.2006).

Kugler, F. X. (1927) *Sibyllinischer Sternkampf und Phaethon in naturgeschichtlicher Beleuchtung*, Aschendorffsche Verlagsbuchhandlung, Münster.

Marshall, P. K. ([2]2002) *Hyginus. Fabulae*, Saur Verlag,

München/Leipzig.

Norton, O. R. (2002) *The Cambridge Encyclopedia of Meteorites*, University Press, Cambridge.

Papamarinopoulos, St. (2005) *Plato's Phaethon and Homer's Phaethousa. Cometary Fragments in the 12th Century B.C.* (Abstract: http://milos.conferences.gr/index.php?id=2851; 7.5.2006).

Rösler W., Hoffmann V., Raeymaekers, B., Schryvers, D. and Popp, J. (2005) *Diamonds in carbon spherules – evidence for a cosmic impact?* (http://www.lpi.usra.edu/meetings/metsoc2005/pdf/5114.pdf; 7.5.2006).

Spanuth, J. (1965) *Atlantis. Heimat, Reich und Schicksal der Germanen*, Grabert-Verlag, Tübingen.

Statius, *Thebaid* (http://www.thelatinlibrary.com/statius/theb1.shtml; 7.5.2006).

Stüve, W. (1900) *Olympiodori in Aristotelis Meteora Commentaria*, Georg Reimer, Berlin.

Taylor, Th. (1998) *Proclus' Commentary on the Timaeus of Plato*, vol. 1, The Prometheus Trust, Frome.

Thurn, I. (2000) *Ioannis Malalae Chronographia*, de Gruyter, Berlin/New York.