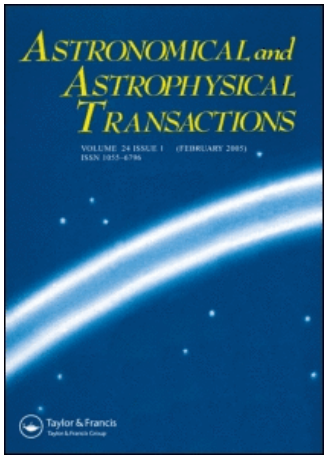

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St. Petersburg's XVIIIth century academician Franz Ulrich Theodor Aepinus and the beginning of physical research into planets and comets

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St. PETERSBURG'S XVIIIth CENTURY ACADEMICIAN FRANZ ULRICH THEODOR AEPINUS AND THE BEGINNING OF PHYSICAL RESEARCH INTO PLANETS AND COMETS

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One of the first steps towards physical planetology is discussed. An attempt to analyse general physical properties of the Earth, the Moon and comets was made. As a result the discovery of the Antarctic Continent was predicted and the first attempt of the description of the physical processes in comets and a scientific resolution of the comet hazard problem were made.

KEY WORDS History of astronomy, planetology, geophysics, meteorology, geography; lunar craters; comets, the comet hazard; the Antarctic Continent; personalia (Aepinus)

1 INTRODUCTION

To get started, let us recollect what lots of people know. Franz Ulrich Theodor Aepinus was born in 1724, December 13 in the town of Rostock in Germany. He graduated at the universities of Rostock and Jena and had the Doctor's of medicine degree. Till 1755 he was privatdocent in the first one and professor of astronomy in the Berlin Academy of sciences (till 1757). In 1757 he was invited to the St. Petersburg academy of sciences as a professor of physics and held this post until his resignation in 1798. In Russia took Russian citizenship. He was also a high official in the Russian Foreign Ministry in the reign of Catherine the Great. On her demand Aepinus elaborated a new system of education for Russia. From 1765 he was the tutor of the future Emperor Paul Ith. F. U. Th. Aepinus was a foreign member of Stockholm and some other academies of science. F. U. Th. Aepinus died in 1802 on August 10 (22 New Style) in Dorpat (Tartu, Estonia).

Aepinus enjoyed a great reputation as a distinguished physicist, who discovered pyro-electricity, explained electrostatic and magnetic induction, and was the author of the first quantitative mathematical theory of electrcity based on Newtonian

physics. But Aepinus' great contribution in geophysics, meteorology and especially in astronomy is nearly unknown yet, although he was the author of about 30 papers in these subjects.

2 AEPINUS AS THE MAN WHO HAD PREDICTED THE DISCOVERY OF THE ANTARCTIC CONTINENT

As a geophysicist Aepinus was one of the pioneers (after W. Gilbert in the seventeeth century and E. Halley at the beginning of the eighteenth century) who began the study of our planet's global features. In his work "Tractate on Division of Term throughout Terrestrial Sphere" (Aepinus, 1761) Aepinus explained the phenomenon of more low temperatures on the Eastern Hemisphere by the existence of the very great continents there and on the contrary the mild climate on the Western Hemisphere by the existence there of many seas and oceans. Analogically, analysing information from voyages of Russian sailors in very high latitudes of the Northern Hemisphere and on the contrary – the inaccessibility of more low ones in the Southern one (because of the abundance of ice-flous and ice-fields there) Aepinus explained this not only by astronomical causes (it is known that summer-period in the second one is shorter than in the first), but moreover concluded that a great continent near the southern Earth's pole must exist. Therefore Aepinus firmly predicted the discovery of the Antarctic Continent on good foundations already in 1761, 13 years before James Cook's first voyage to the southern latitudes and 60 years before the Russian expedition of F. Bellinsgausen and M. Lasarev, that made the point of this problem.

3 AEPINUS – THE ASTRONOMER

3.1 The First Guess about the Ice-Nucleus of Comets

Aepinus' astronomical papers (about 10, published between the 40 and 80th years of the eighteenth century) were connected with celestial mechanics, instruments, and signifcant expected astronomical events, especially the first return in 1758 of the comet discovered in 1682 and later named "the Halley' comet" predicted by Halley and the passage of Venus across the solar disc (1761). In astronomy Aepinus was one of the early astrophysicists and evolutionists. He put his mind to the problem the physical constitution of celestial bodies and physical processes there. Similar subjects were very out-of-the-way in the eighteenth century. Besides his scientific papers joined an artistic, emotional form and a deep original treatement of the matter.

He was very interested in comets as the most changing celestial bodies. In his small but very interesting paper "Discussion about the structure of the World" written in 1759 on the basis of Fontenelle's "Conversations about plurality of inhabited worlds" (1686) and anonymously published in German (1770) and in Russian

(1770, 1783; Epinus, 1770) Aepinus instead of the Cartesian picture of world (at Fontenelle) presented a new, Newtonian picture of the Cosmos and besides added his own original ideas about physical processes in it.

In the eighteenth century an approach of a comet to the Earth and a passage of the Earth through its tail excited horror, because people waited for many catastrophes: fires, floods, and maybe, removal of our planet from the Sun!... – Aepinus explained clearly that the passage of the Earth through the tail of comet is safe for us because of the insignificant density of matter of a comet tail, through which even the smallest stars are seen. But Aepinus showed the great danger of the Earth's collision with a comet nucleus. However he admitted that even in this case the catastrophe would not be happen if the atmosphere of this planet were dense enough and therefore the comet could be flouwn off by the compressed air. (By the way a similar idea was put forward in our time to explain the famous Tunguska-phenomenon.)

In his emotional description of the "life" of the comet discovered in 1680 (P = 570 years) Aepinus created an original model of certain physical processes on its surface on its way to the Sun.

Aepinus advanced first the idea of a comet's ice-body (nearly one century before P. S. Laplace and 65 years before F. W. Bessel):

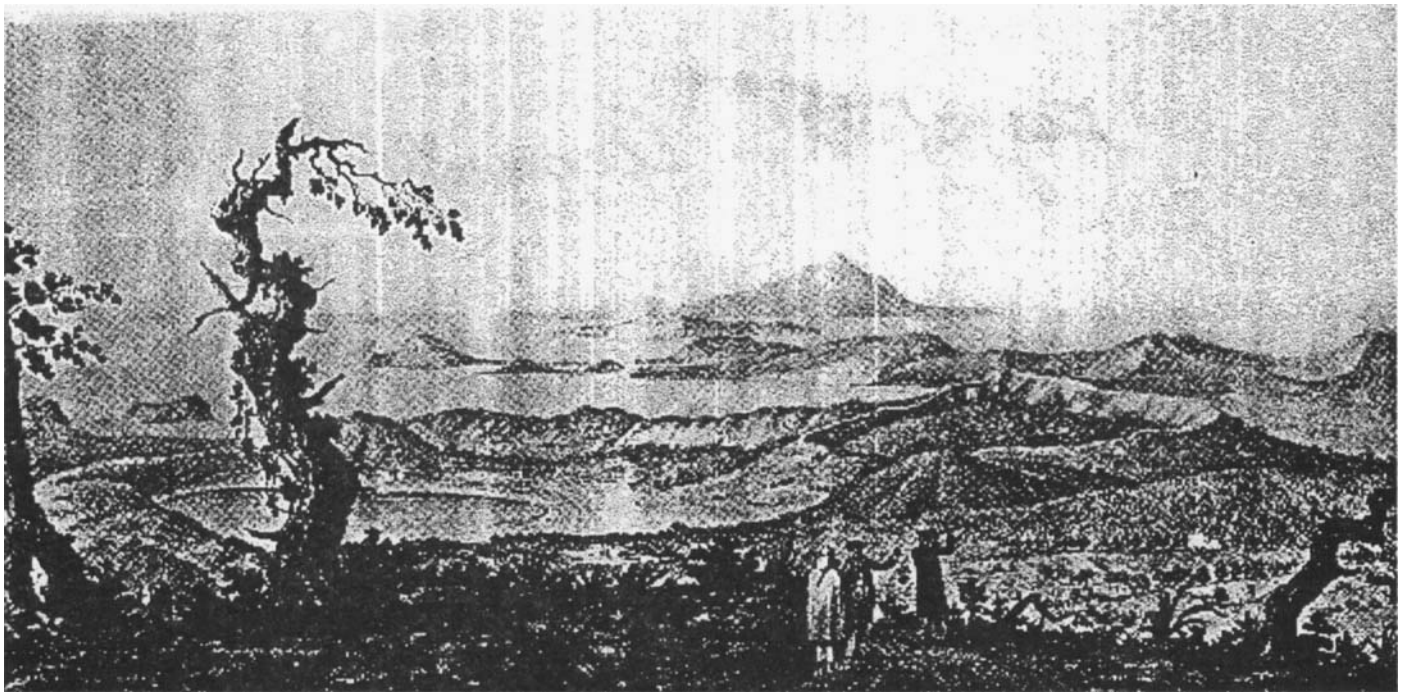
"From the terrible emptiness, where gloom and death reign unimpeded for incalculable thousands of years, this comet hurries to the immeasurable Fiery-Ocean. She is embraced all by cold, the whole turned into stone by frost. The fire's force breaks these hardest cold's bonds soon after; the devouring fire outstretches suddenly on the whole surface of it. Its seas dry up, mountains are smoking. The air circle around it filled with the burning fume is boiling already and suddenly sprawling. Now the condensed smoke originating from this ruined world is pouring unimpededly to the bottomless depths, now the terrible tail is spreading over the fathomless abyss over the more two million of the diurnal way." (Epinus, 1770, pp. 38–39).

In this work Aepinus suggested it was perhaps comets that replenished the supply of solar energy, falling on to it and burning down in its bowels. (A similar idea seems to have been suggested first by I. Newton and repeated in the middle of the nineteenth century by Robert Mayer.)

3.2 Aepinus and His Volcanic Hypothesis of the Moon's Craters Origin

But the most important of Aepinus' astronomical contributions was his small paper "On the structure of the Moon's surface and the origin of its relief from the inside fire" [in German (Aepinus, 1781) and partially in Russian (Epinus, 1781)]. It was added to by his small article in 1788 on the same subject. In this paper he has described his own observations of the Moon's craters with a new achromatic telescope that he had received in 1778 from England and admitted the explanation of their origin.

One of the global problem of the natural history in the eighteenth century was the problem of volcanoes and their role in the formation of the Earth's relief. Aepinus



The Campi Phlegraei, as depicted by Pietro Fabris (Hamilton, *Campi Phlegraei*, Plate XVII).

Figure 1 The Burning valley – the assumed volcanic craters in neighbourhood of Vesuvius (from W. Hamiilton's album "Campi Phlegraei", 1776).

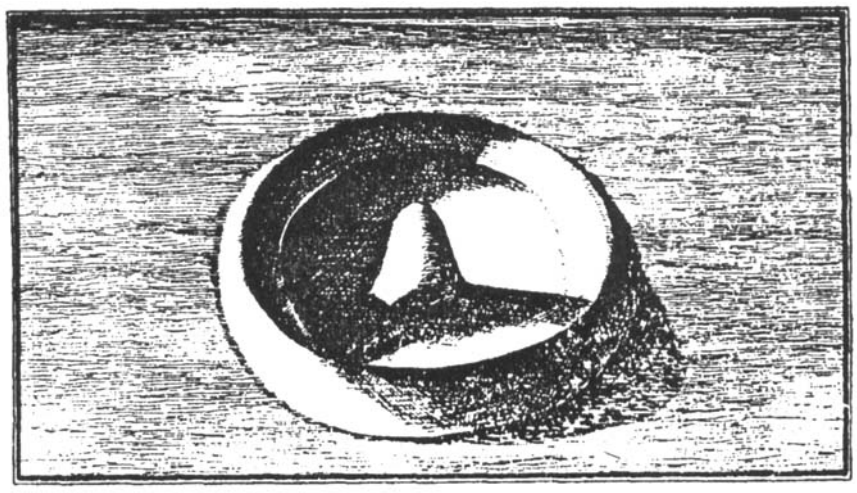


Figure 2 The diagram of lunar crater (from Aepinus' work "On the structure of the Moon's surface etc.", 1781).

was deeply interested by this problem and supported the new theory of the French geologists J. E. Guettard (1756) and N. Desmarest (1774) on the essential role of volcanoes in the formation of mountains. Aepinus knew about the colourful album by Sir W. Hamilton "Campi Phlegraei" (The Burning Valley, Vol. 1–2, 1776–1779), with many pictures of Vesuvius after its eruption in 1766 and many small craters in its neighbourhood (Figure 1). Besides in his work Aepinus described some others volcanoes in the Naples neighbourhood.

Observing the Moon's surface Aepinus caught a likeness between the Moon's craters and volcanoes on the Earth (if you look mentally at ones from a great altitude) (Figure 2, Figures 3*a*, *b*). Moreover he suggested that perhaps the variety of the Moon's craters forms and dimensions testify of its evolution to our time and therefore the Moon's geological activity. This last Aepinus' idea was his most considerable contribution to the formation of the new evolutionary astronomical world picture. The idea of volcanical origin of Moon's craters was advanced by Aepinus independently of the similar, but only theoretical and already forgotten guess of R. Gook (1665).

Aepinus' theory of moon's craters was caught up by G. C. Lichtenberg (1781) and then was confirmed one would think by W. Herschel's observations of some bright points on the dark side of the Moon (1783–1787).

At first this subject was discussed by R. W. Home, from the University of Melbourne (Home, 1972) and then by the author (Eremeeva, 1975).

G. W. Olbers (1795) and P. S. Laplas (1802) took the first theory of the Moon's volcanoes as a possible realistic cosmic source of "aerolites". And this was a first astronomical confirmation of the Chladni's new cosmic theory of meteorites (1794).

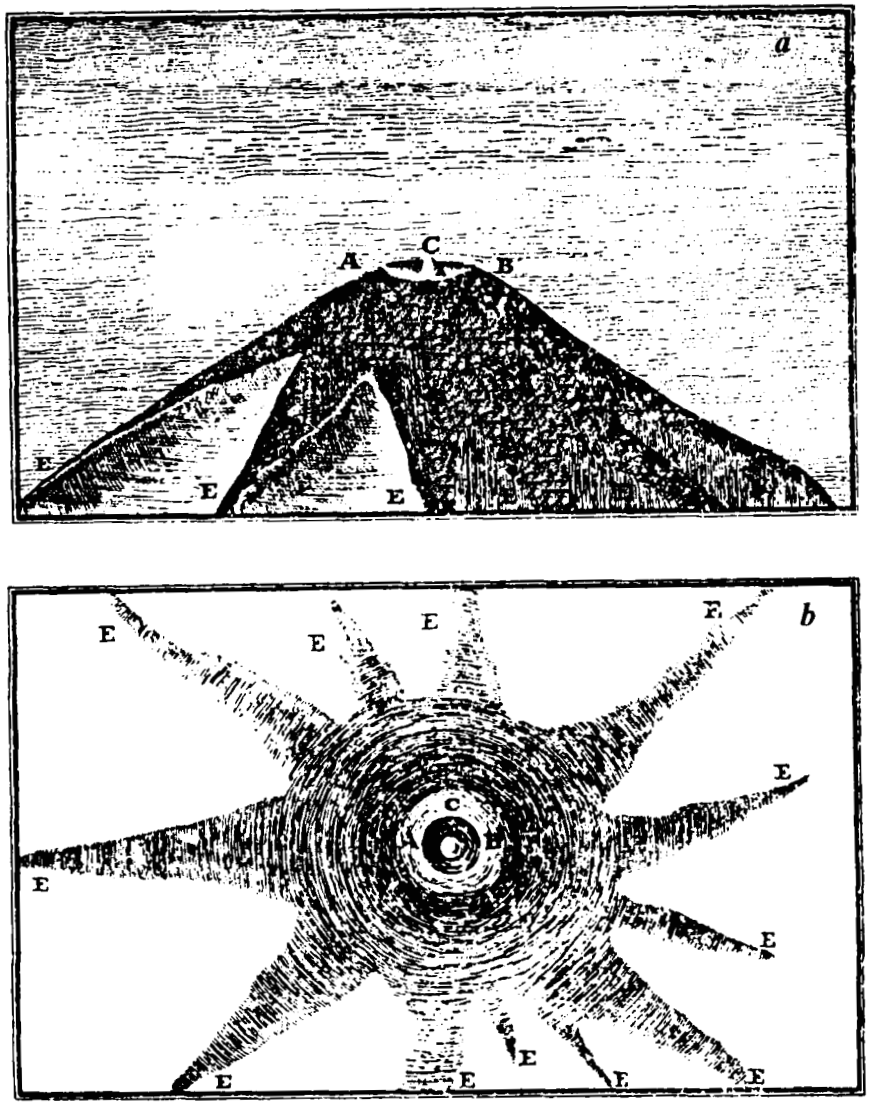


Figure 3 The diagrams of the Earth's (Jb. – see Figure 2) volcano (obviously Etna).

Afterwards becaming acquainted with similar ideas of Gook Aepinus wrote in one of the letters to P. S. Pallas who had informed him about W. Herschel's observations that the name of Robert Gook must be placed on the Moon's map when the first volcano will be discovered reliably there [Lettre de ..., 1788]. And later one of the Moon's crater was named "Gook". But yet Aepinus' name – the name of the author of the first evolutionary volcanic theory of Moon's craters is missing there.

The author of this paper hopes this mistake will be put right in future. And the name "Aepinus" will be on maps of the Moon and of the Antarctic Continent.

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