

# The energy – based theory explaining dinosaur extinction and selectivity of Cretaceous – Tertiary extinction event coincided with a large meteorite impact

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## ABSTRACT

This is our concise interdisciplinary energy theory explaining dinosaur extinction and the energy-based interpretation of the natural world. The theory proposes ideas which build on Luis Alvarez's impact theory by adding the energy-based mechanism underlying the mass extinction event—the final missing element to make the famous theory complete. Dinosaurs and other creatures of the Mesozoic Era differ from the commonly accepted image to which we are used.

**Keywords:** Energy; extinction; ELEL; domination; temperature; crush; meteorite

## 1. INTRODUCTION

Luis and Walter Alvarez proposed in 1980 the impact theory for dinosaur extinction, which claimed that a large body from outer space collided with Earth. They had found the direct reason for the mass extinction 65 million years ago, but it was not known why the extinction was so selective in its nature, why even the smallest species of dinosaurs did not survive [2]. Palaeontologists base their hypotheses mainly on the biological structure of unearthed mineralised remains or traces of past organisms [3].

Some energy phenomena in nature, and most of all their consequences for all living beings, are constant regardless of the time they take place. The energy principles which apply today were just as valid 100, 300 or 500 million years ago [1,4].

Having analysed today's world of living beings in terms of energy principles applicable to this world, and then having excluded those paleontological hypotheses which were inconsistent with these regularities an energy-based mechanism underlying the mass extinction event can be formulated.

## 2. THE ENERGY-BASED THEORY OF DINOSAUR EXTINCTION

From the point of view of contemporary science there are still no logical answers to the questions posed below:

Why did all the species of dinosaurs die out? After all, apart from the best-known giants there were also species of very small dinosaurs. Why did they perish, too? Why had mammals, which coexisted with dinosaurs, not been able to break through the dominance of the latter for over 135 million years? After all they were warm-blooded.

The energy theory proposed an answer to this question as early as in 1997 and expands on Luis and Walter Alvarez's impact theory by attempting to explain the mechanism for the massive dinosaur extinction 65 million years ago.

We based our theory on a number of energy rules which in our opinion apply without exception to the natural world:

### 1. *Competition for energy*

Every being needs energy to exist and function [1]

### 2. *Huge differences in energy needs*

Living organisms are highly varied in terms of energy consumption. The differences are colossal and closely linked to the temperature of blood, expressed in the average body temperature of the animal

### 3. *The great significance of one degree Celsius difference* [4]

A temperature difference of as little as one degree is a lot. It makes a significant difference in the demand for food. The correlation between the demand for food (energy) and the average body temperature is nonlinear. This means that large, disproportional changes in the demand accompany small differences of temperature.

### 4. *Energy-based law of dominance* [4]

In warm-blooded animals, each additional degree in the average body temperature corresponds to a non-linear (exponential) growth in the body's functional performance (capacity for generating own energy). Activity grows, and so do endurance and ability to compete with other species. What results from this is, in our opinion energy law of dominance applicable to nature. According to this law, animals with higher average body temperature can never be subjugated as a species by animals with a lower body temperature.

### 5. *Hazards inherent in high energy needs*

The higher the body temperature, the lower the resilience and tolerance of temporary energy deficits.

## 2. 1. The sequence of events based on energy theory

Following the biggest extinction event in Earth's history, the Permian on Earth there emerged small animals with a new quality. This quality was warm-bloodedness.

According to our theory, not only mammals but also all the species of dinosaurs without any exception were warm-blooded.

In the Late Triassic dinosaurs took over control on land for more than 130 million years. Mammals, despite also being warm-blooded, yield to the absolute and long-lasting domination of dinosaurs. Dinosaurs had a higher blood temperature than mammals, higher

rate of metabolism, higher performance and higher energy needs comparing animals of the same body weight.

Dinosaurs were not the only animals with a higher blood temperature than mammals; they were part of a bigger family of high-temperature warm-blooded animals (we named them HBTCs—High Blood Temperature Creatures), which also included pterosaurs, ichthyosaurs, plesiosaurs, and later mosasaurs and birds, too.

HBTCs became the unquestionable rulers of Earth. Dinosaurs conquered all lands. The high-energy pterosaurs conquered the skies and dominated the air. High-energy warm-blooded land animals conquered also the waters and to adapt to the needs of the new environment had completely changed their appearance.

Mammals constantly in danger, tracked by the predatory, high-energy, and thus faster, with sharp senses and ever-hungry dinosaurs and other HBTCs, they did not stand a chance of breaking through their dominance (Fig. 1).

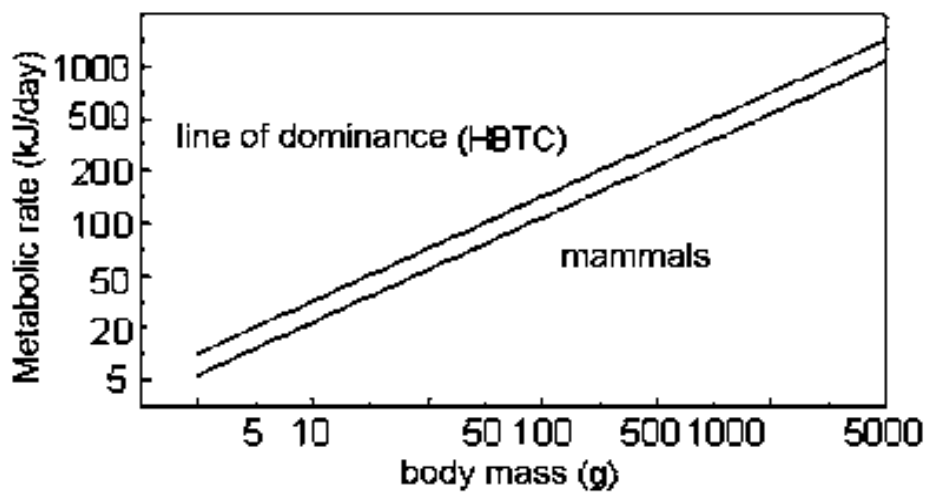


Fig. 1. Proposed relationship between the speed of metabolic processes and body mass.

Obviously, this chart cannot possibly be based on authentic calculations of the relationship between the speed of metabolic processes and body mass. It presents the nature of this relationship and graphically demonstrates the reasons why HBTCs dominated over mammals and the latter were not able to break through this dominance.

After extremely long time of HBTC domination some 65 million years ago the collision of a giant celestial body with our planet constituted the end of the world for all dinosaurs and all other HBTCs except birds. But what was the mechanism behind this mass extinction? Why did dinosaurs not manage to survive?

Two factors contributed to its high energy needs of the then-dominant HBTCs (including dinosaurs) coupled with the energy crash on Earth caused by a temporary break in the supply of solar energy indispensable to plant life, and indirectly to animal life. Half of the plant species disappeared from the face of the Earth forever.

Dinosaurs and all other HBTCs were the finest creatures, but they needed the most food per unit of body mass. What helped them dominate the world for many millions of years—the capability of consuming and processing the largest amounts of energy to maintain vital processes—became the cause of their extermination.

The only HBTCs who did not die out completely were birds, though fossil records show that they, too, were on the brink of extinction [5]. It is hard to say why they were the only ones among all the HBTCs that did not die out completely. Perhaps it was a stroke of luck, or maybe the ability to fly. It is also possible that the other flying HBTCs, known as pterosaurs, had even higher energy needs.

In the aftermath of the asteroid impact, mammals too found themselves in a difficult situation, though it was not as dramatic as that of birds and other HBTCs. Some species survived the toughest times by requiring much less energy compared to their body mass than HBTCs.

Cold-blooded animals were the least affected, for although they were considerably less active and more dependent on the ambient temperature, they had radically lower energy needs, and were capable of surviving without food for much longer. Reptiles, such as turtles, crocodiles, lizards or snakes, did not suffer as greatly as warm-blooded creatures. Even relatively large reptiles survived the mass extinction.

At the beginning of the Cenozoic era mammals were small, but according to the energy-based law of dominance, they could not and were not blocked in their development by the lower-energy, even if much larger, reptiles. However mammals also had other competitors than reptiles that, despite having been decimated, still lived at a higher energy level. In this case, the competitors were birds, the only surviving HBTCs. The giant flightless rapacious birds became the primary predators, a threat to all animals, including mammals for many million years.

## 2. 2. The energy level of life on Earth

Let us consider three energy streams with different intensities:

- $S_S$  – solar energy stream reaching Earth and supplying it with energy amounting to  $E_S$  per unit of time. To make things simple, it can be said that it is the total amount of “fuel” reaching Earth. We have omitted the influx of energy from other sources than space (from within Earth’s centre) on purpose, as its significance is marginal in the energy balance sheet under consideration.

- $S_P$  – part of the solar energy stream captured by all the plants on Earth and assimilated by them in the process of photosynthesis. In other words, it is the part of “fuel” that has been harnessed and used to activate plant life.

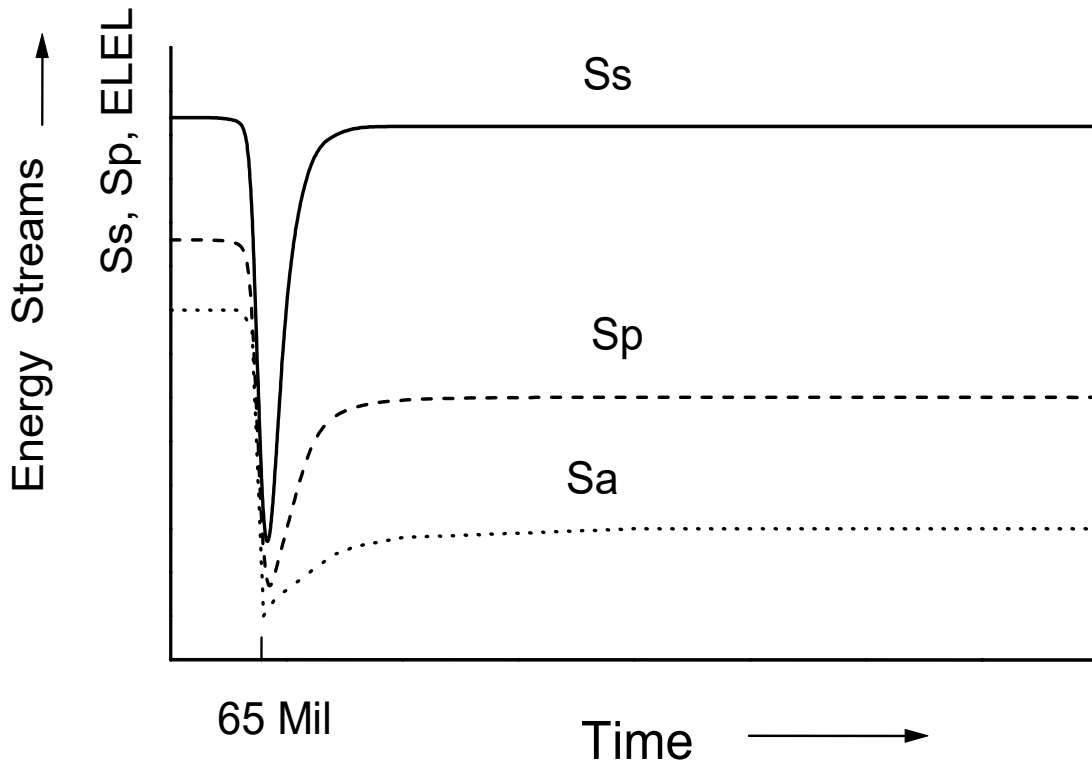
- $S_A$  – energy stream absorbed by animals from plants by feeding on them. It is, therefore, the part of flora which animals managed to use as “fuel”. The cross-section of this stream swells or wanes over time. These changes are practically unnoticeable judging from the perspective of a human life, yet they are evident over millions of years. We do not know how  $S_S$  changed over hundreds of millions of years, but considering its proportions to  $S_P$  and  $S_A$ , we can – for the sake of simplicity – assume its value as constant.

$S_P$  and  $S_A$  are and have always been a minute fraction of a percent of  $S_S$ .

$S_P$  and  $S_A$  amounted to zero before life appeared on Earth.

From the moment life emerged on our planet, both values changed over time—increasing or decreasing. Today, too, they are subject to constant change. Over the period of a human life, and perhaps even thousands of years, these changes are inconspicuous.

This seeming changelessness, however, is of a dynamic nature. From the perspective of tens of millions of years these changes have been enormous.



**Fig. 2.** Three energy streams.

In order to interpret energy phenomena in the natural world over hundreds of millions of years in a clearer manner, we have introduced an auxiliary function, useful to our further considerations. Life on Earth entails a constant flow of energy.

The amount of solar energy flowing in a unit of time (e.g. in a year) through all those plants which serve as food for animals on Earth determines the energy level of life on Earth. We have labelled this intensity the Earth Life Energy Level (ELEL).

We want to emphasise that the ELEL is not the stream of solar heat. It is a tiny portion of solar radiation, captured by plants, processed and stored by them in the form of chemical energy, which is subsequently consumed by animals.

Thus, the ELEL is a function of the intensity of the energy flow driving vital processes of fauna (the animal world) worldwide.

The ELEL is a key function for us, determining the energy level of vital processes on Earth, very useful in the comparison of previous energy situations with the world today.

There was a time in the history of Earth, when the ELEL amounted to zero (when there was no life on our planet yet), and a time when it was a millionth of a fraction of what it is today (when life was in its initial stage).

On the other hand, in the Jurassic and Cretaceous periods, when Earth was dominated by high-energy dinosaurs and other high-energy animals, the ELEL was much higher than it is now (Fig. 2).

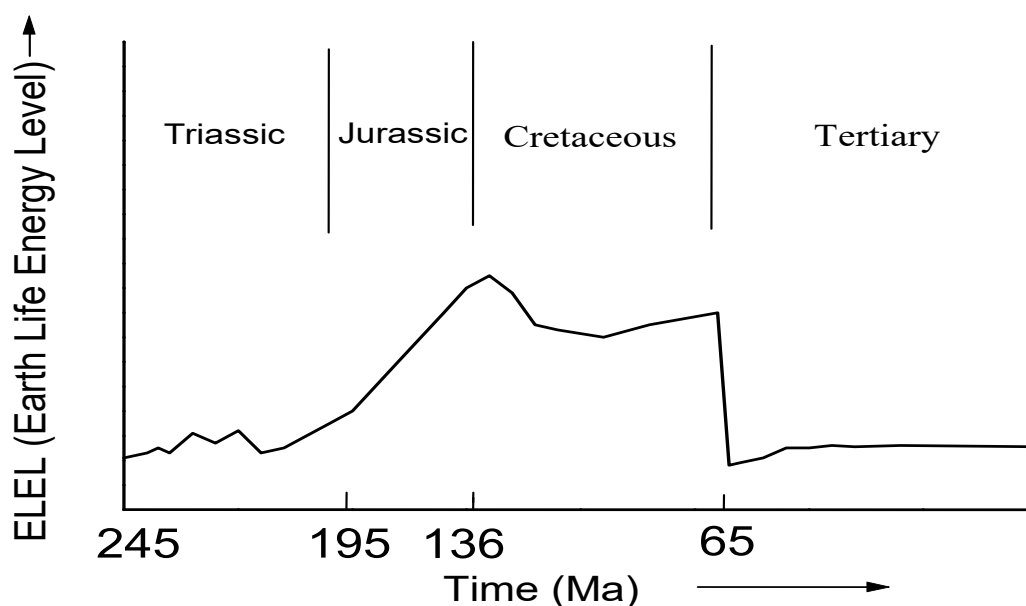


Fig. 3. Energy crash and energy corrections.

The figure represents the energy crash and corrections, but it cannot represent any actual measurements of the ELEL—it is simply a graphic concept demonstrating how an actual ELEL chart might be presented as a function of time.

Anyway the above figure shows that the Earth Life Energy Level (ELEL) 65 million years ago after the great meteorite impact due to the radical although short-lasting limitation of solar energy supply dropped dramatically and despite the return of light to our planet could not return to the similar level. The energy crash occurred.

Meteorites with diameters of about 1 mm strike the Earth about once every 30 seconds. Meteorites of larger sizes strike the Earth less frequently.

Objects with sizes greater than 1 km and considered to be catastrophic strike the Earth relatively infrequently [6].

One of them was the one that struck Yucatan Peninsula about 65 million years ago and thought to be responsible for the extinction of the dinosaurs and creation of the Chicxulub Crater 180 km in diameter.

In March 2010 an international team of 41 scientists determined the size of the meteorite as a 10–15 km.

The amount of energy released by an impact depends on the size of the meteorite and its velocity.

The one that struck Earth 65 million years ago released energy equivalent to more than 100 million megatons of TNT.

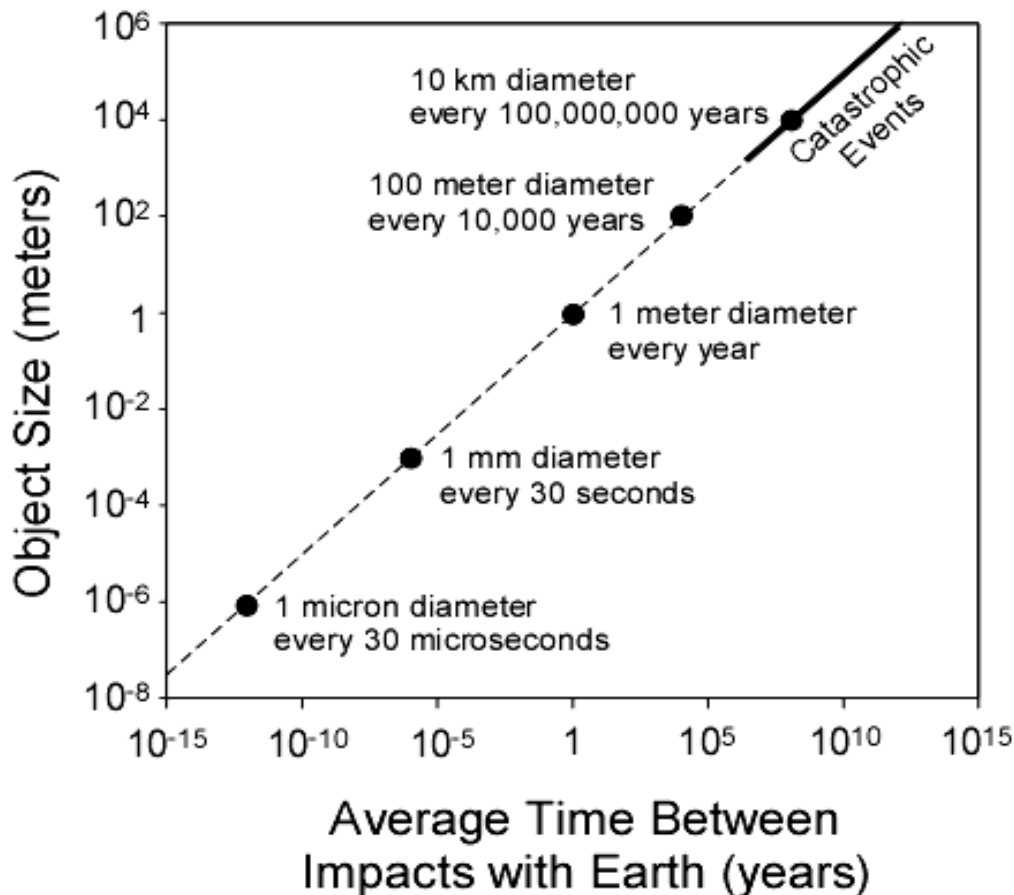


Fig. 4. Statistic frequency of meteorites strikes [6].

### 3. CONCLUSIONS

1. Dinosaurs were not cold-blooded like contemporary reptiles. All dinosaurs species were warm blooded animals.

2. All dinosaurs had higher blood temperature than the mammals, higher metabolism level, higher physical efficiency and much higher energy demand in relation to the body weight unit /comparing the animals of same weight /.

3. The dinosaurs were not the only animals having the blood temperature higher than the mammals; they belonged to the greater family of high-temperature animals, HBTC (High Blood Temperature Creatures); apart from the dinosaurs, to the HBTC belonged ,among other Mesozoic period animals as pterosaurs, ichthyosaurs, plesiosaurs, mosasaurs and birds. Individual species of the HBTC /including also the species of dinosaurs/ could slightly differ between themselves as regards their blood temperature, but on average /in the case of animals having the similar body weight/ those temperature was always within a range which exceeded for the blood temperature of mammals . It was the reason of HBTC dominance.

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4. In the case of the warm blooded animals, physical efficiency of organism (capability to generate the self-energy) strongly increases with every degree of blood temperature. At the same time, with every degree of blood temperature energy demand of organism rapidly increases. It is nonlinear dependence.

5. Life on the Earth is connected with the incessant flow of energy. Amount of energy flowing in a time unit through all animal organisms on the Earth defines the mathematical function - Earth Life Energy Level. The ELEL can be defined as the amount of solar energy assimilated in a time unit by all those plants on the Earth which serve as food for animal organisms. The ELEL changes slowly with time and it is a very small fracture of the amount of solar energy reaching the Earth.

6. The Earth Life Energy Level (ELEL) more than 65 million years ago was much higher than currently. After the great cosmic catastrophe due to the radical although short-lasting limitation of solar energy supply almost all HBTC (among them all dinosaurs) had died out. The ELEL dropped dramatically and despite the return of light to our planet could not return to the similar level because the most perfect and effective animal programs had been destroyed. The energy crash occurred.

7. High energy demand of dinosaurs and the other dominating organisms was the reason why they had not survived.

8. The birds had also almost become extinct 65 million years ago. They are the only HBTC which have survived the energy crash.

9. The world of nature which existed on the Earth 65 million years ago, i.e. before the energy crash, was quite different from the one described up to the present. It was not the world dominated by the gigantic cold-blooded reptiles but by the warm-blooded animals incomparably more perfect, extremely dynamic with the excellent perception and unimaginable behavior.

10. The evolution is only partially responsible for elimination of all species which have disappeared from the face of the Earth. It was the energy crash which had eliminated the most perfect animals and plants from the evolutionary point of view. Many of them were considerably surpassed the contemporary species.

11. Appearance of the dinosaurs was different from the one commonly presented. They could not be naked, covered by a reptile skin only. They had to have some kind of high-quality insulation. It could be something which protected against loss of heat, probably a kind of special down or feathers.



**References**

- [1] Knut Schmidt-Nielsen “*Animal Physiology: Adaptation and environment*”, 4-th edition, Cambridge University Press (1990).
- [2] Walter Alvarez, “*T. Rex and the Crater of Doom*”, 3th edition, Princeton University Press (2008).
- [3] Doug Macdougall “*A short history of planet Earth*”, Polish edition, Prószyński i S-ka, Warszawa (1998),
- [4] Ryszard Gawle, Zbigniew Czech, „*Dinosaurs and the Power of One degree Celsius*”, 2<sup>nd</sup> printing, 1<sup>st</sup> English edition, Media Zet, Piła (2010),
- [5] Alan Feduccia, *Science* 267 (1995) 637-638,
- [6] Stephen A. Nelson, “*Meteorites, Impacts and Mass Extinctions*”, Tulane University, New Orleans (2011).