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# A New View of the Mass Extinctions and the Worldwide Floods

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## Abstract

In this study, the reasons for mass extinction in Jurassic were investigated. It was shown that galactic compression led to the activation of terrestrial nuclear reactors, which in turn led to the changes in tectonic activity, volcano eruptions, LIPs, MORBs, paleoclimate change, drift of continents, narrowing of the Earth, worldwide floods, tsunami, changes in mantle and core structures, in magnetic fields and in sedimentary isotopes. It was shown that the mass extinctions occurred during worldwide floods, caused by the narrowing of the Earth at the time of galactic gravitational compression. It was shown that the average statistical altitude distribution of dinosaurs has a bimodal distribution and corresponds to permanent migrations between the plains and the hills. It has been suggested that the skeletons of dinosaurs are well preserved as a result of covering the bodies of dinosaurs with mud flows of coastal sediments and the soil layers at worldwide tsunami. It was formulated the requirement to paleontology, consisting in the obligatory registration of altitudes of the actual place of the fossils found. The simple explanation of the presence of boundaries in the structure of the Earth is given: the $^{40}$K nuclear layer corresponds to the boundary between upper and lower mantle; the $^{137}$Cs layer located on the boundary between the lower mantle and the outer core; the Th-U nuclear layer is a border between outer and inner core. The previously abstract theories of subduction and continents drift have a clear and obvious physical sense. It was shown that the standard geological table is a registration book of galactic events during Paleozoic. It is proposed to restore the structure of the galactic arms by the geological deposits on the Earth. It was suggested to create the stations on elevated hills for rescue and regeneration of biological forms in the future.

## Keywords

Planet Size, Milky Way Galaxy, Natural Nuclear Reactor, Mass Extinction, Sea Level, Worldwide Flood, Jurassic, Fossils

# 1. Introduction

## 1.1. Mass Extinction Events

The mass extinction events occurred regularly through the Phanerozoic, see for detail review in [1]. In particular, in the Jurassic period, to which this study is devoted, the Triassic-Jurassic (201.64 Ma) and Toarcian (182.60 Ma) mass extinctions happened.

The mass extinctions were often related to kill mechanisms such as marine anoxia, global warming, ocean acidification coupled with changes in atmospheric greenhouse gases, toxic metal poisoning, meteorite impact and cosmic gamma rays. Now it is increasingly widely thought that large igneous province (LIP) eruptions might be the driver of many of the purported proximal kill mechanisms [1]. However, let's recall that mass extinction theories have developed from the simple "death-by-sea-level-change" hypothesis, which was proposed almost fifty years ago by Newell [2]. Hallam and Wignall confirmed Newell's regression hypothesis for at least some major and minor extinction events [3]-[7]. In particular, in these studies it was proposed sea-level rose during the period from the latest Permian to the earliest Triassic, and that the oceanic anoxia caused by the continuing sea level raised that triggered the mass extinction. In [8], it was pointed out that the spread of anoxic bottom waters associated with marine transgression, sometimes, but not always, preceded by a major regression. It was also a potent extinction mechanism, presumably because of the severe reduction of viable habitat area. Authors took attention on the fact that the ultimate cause of the sea-level changes is generally unclear due to a glacioeustatic driving mechanism that can be convincingly demonstrated only for the end Ordovician and end Devonian events.

However, in [9] it was asserted that it is unlikely that sea-level fall played a significant role in the Triassic-Jurassic boundary extinctions in either a local or a global context. Detail discussion of a sea level role in mass extinction and discussions could be found in [9]-[13]. Thus, it was formed opinion that the Triassic-Jurassic mass extinction was related to a pronounced eustatic sea-level rise and partly to tectonic collapse anticipating the formation of ocean nearby, a phenomenon bound up with the creation of the proto Mediterranean and Atlantic oceans.

In particular in [14] [15], it was pointed that the cause of the end-Triassic mass extinction was probably linked to the contemporary activity of the Central Atlantic Magmatic Province (CAMP), which heralded the breakup of the super continent Pangaea. In that way, the possible kill mechanisms associated with magmatic activity include sea-level changes, marina anoxia, climatic changes, release of toxic compounds, and acidification of seawater.

As Triassic-Jurassic boundary mass extinction, the Toarcian mass extinction that happened in the Early Jurassic was an object for many studies and it was excellently described in the literature [1]. The Toarcian extinctions happened in the several parts of the world, such as Northwest Europe, South America and

North America, Tibet and Japan, which proved that these mass extinctions have revealed the global nature of the crisis. According to [1] [15] [16], the Toarcian mass extinction has relation to the Karoo and Ferrar Traps in southern Gondwana.

In a number of studies the relations between mercury and mass extinction were investigated, see e.g. [16]-[27]. The Hg enrichment in sediments could be derived from massive volcanism and LIPs, from the combustion of coal deposits, from a meteoritic source, or from biomass burning due to wildfires and soil erosion [28] or from post-depositional processes [23]. In [25], it was shown that the Hg and paleontological evidences from the same archive indicate that significant biotic recovery did not begin until CAMP eruptions ceased.

However, these studies did not provide a physical explanation for the correlation between sedimentary Hg enrichments and massive volcanism. Indeed, what is the fundamental geophysical difference between the massive CAMP and Karoo-Ferrar LIPs from St. Helen or Pinatubo eruptions? We will notice that on the slopes of St. Helen and Pinatubo the mercury rivers did not flow. In this study, we answer on a question of what distinguishes between volcanic emissions during shallow and deep convection in the inner layers of the Earth.

Further, we should also mention the studies, in which the possibility of the galaxy influence on extinction processes was discussed.

Napier and Clube proposed the idea that gravitational disturbances caused by the Solar System crossing the plane of the Milky Way galaxy are enough to disturb comets in the Oort cloud surrounding the Solar System [29] [30] [31] [32]. The disturbance sends comets towards the inner Solar System. It raises the chance of an impact. According to the hypothesis, this results in the Earth experiencing large impact events about every 30 million years. Further, this hypothesis was evolved to the "*Shiva*" hypothesis (Shiva-Hindu God of Destruction) and has been investigated in the series of studies [33]-[39].

Also, note that periodicity of extinctions in the geologic past was investigated by Raup and Sepkoski Jr. [40]. In this study, a definition of the conception of "bottlenecking" effect of mass extinction was introduced. In study [41], it was written about periodic mass extinctions and the Sun's oscillation around the galactic plane (**Figure 1(a)**).

The NASA image of the Milky Way Galaxy is presented in **Figure 1(b)**. In this study a photo of the Milky Way Galaxy, NASA/JPL-Caltech/R. Hurt (SSC/Caltech), [42], which is available at the NASA/JPL-Caltech website, was used. The general structure of the Milky Way galactic arms and the parameters of the galaxy can be found in [43] [44]. The places, where the trajectory of the Sun intersects the galaxy arms are indicated by red arrows.

The Sagittarius, Scutum-Crux, Norma and the Perseus arm's location and their relation with Neogene-Paleogene, Cretaceous-Jurassic, Persian-Carboniferous and Silurian-Ordovician stages are discussed in [45]-[53]. Since the primary source of changes in the sea level is the galaxy arms, we briefly highlight

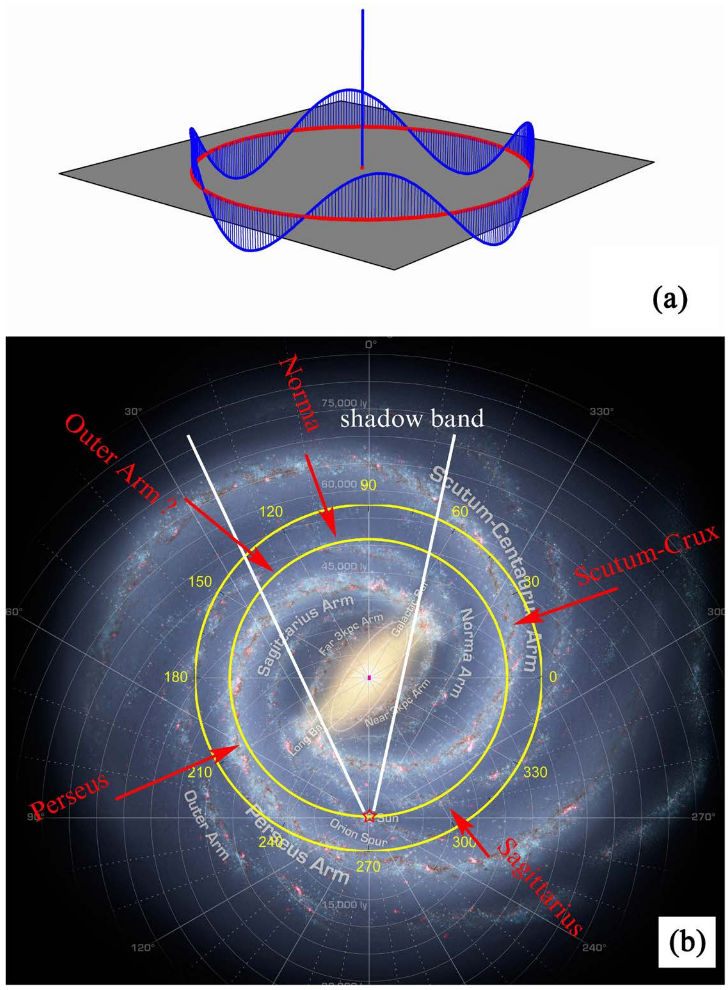



**Figure 1.** (a) The "Galactic carrousel" scheme, adapted from (Rampino, 2002). Combined vertical oscillation of solar system (bold blue line) perpendicular to galactic plane (grey plane), and revolution of solar system around galaxy; (b) The trajectory of Sun rotation around the center of the galaxy was presented as inner yellow line. The Sun position was shown as a red star. The Milky Way Galaxy arms were drawn as "The NASA image of the Milky Way Galaxy". The red arrows indicate the sites, where the Sun route crosses the galaxy arms. The galaxy area invisible from Sun (shadow band), was bounded by two white lines.

the question of the periodicity of galactic processes. During discussion in [54] of a correlation between long-term cyclicities in Phanerozoic sea-level sedimentary record and their potential drivers, it was highlighted that the potential drivers, in addition to major plate tectonic motions, are galaxy cosmic rays and the motions of the Solar System in the Milky Way, see also e.g. [48] [55] [56] [57]. Note that the galaxy influence was also considered in [45] [46] [49] [53] and [58] and references therein. However, in all these works, there is no mention about the possible mechanism of galaxy influence. In our opinion, this effect is through the activation of the earth natural reactor.

The analysis of cyclical nature of geological processes and their connection with galactic frequencies can be found in [59] [60]. The hypothesis about comets as the cause of mass extinction was based on the study by Alvarez *et al.* [61], in which was reported about iridium increases and extraterrestrial cause for the Cretaceous-Tertiary extinction. The discussion about the Alvarez impact theory could be found in [62]-[68] and in numerous references in them. The cyclical frequency of comet, which shower from the Oort Cloud, was studied also, e.g. see in [69] [70] and [71]. By contrast of geological records, sometimes the spectral analysis studies of comet report little or no evidence of statistically significant cycles in impact of crater ages, see for example discussion in [38] [72].

As it was shown above, there are many mass extinction hypotheses, in which the different reasons of mass extinction are substantiated. The arguments in these hypotheses are proved, but these hypotheses form the knowledge mosaic. Is it possible to merge together all these hypotheses? In this study, we try to do it.

The relationship between the mass extinctions, Milky Way Galaxy, natural reactors, LIPs, MORBs, continental drifts and the variation of $^{87}Sr/^{86}Sr$, outlined above, is summarized and presented in **Figure 2**.

In this study we will link together the galactic processes, the activation of nuclear processes inside the Earth and on/in the Sun, as well as the drastic changes in the habitat conditions of land species. Actually, we will renovate the oldest Newell's hypothesis, but we will give explanations based on absolute other principle. The problem of mass extinction of species will be considered using the example of the species extinction in Hettangian and Sinemurian (201.6 - 190 Ma, Early Jurassic), while a statistical analysis of the Saurischia temporal distribution (unranked species) will be given for the whole Jurassic.

Geosciences study the processes occurring in the atmosphere, in the depths of the seas and oceans, and inside our planet. Three basic branches of physical

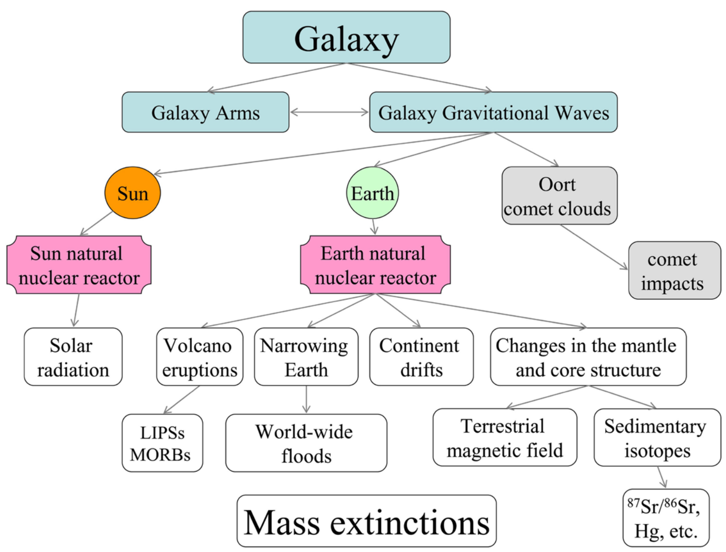



**Figure 2.** The common scheme, which illustrated the relation between the mass extinctions and structure of the Galaxy, is presented. The natural nuclear reactors are the author's contribution on this scheme. The terrestrial nuclear reactor (red rectangle) as a key element merged together different reasons of mass extinction.

sciences, such as atmospheric physics, oceanology and geophysics accordingly are presented. The geophysicists explore the Earth's core and mantle as well as the tectonic and seismic activity of the lithosphere. Moreover, geophysics in the wide sense includes many branches of knowledge: volcanology, seismology, geodesy, geochemistry, geomorphology, paleontology, stratigraphy, structural geology, engineering geology, and sedimentology. The degree of knowledge of various geosciences objects varies greatly. The most studied are the processes occurred in the atmosphere, hydrosphere and lithosphere.

The huge mass inside our planet remains poor or completely unexplored. In this situation, it is necessary to ask geophysicists the simplest questions such as: What is the physical principal of 4-layer Earth's core-mantle models? Is the size of the planet constant? Why is the pressure under the lithosphere higher in the southern hemisphere than in the northern hemisphere? Why did the process of nucleating elements inside the planet stop precisely on iron and nickel? How did elements with an atomic number higher than iron form on our planet? Why continents suddenly break up and start to drift? Is it possible to record a $^{40}K$, $^{235}U$ layer inside the Earth by measuring a geoneutrino? Unfortunately, the geophysics has not answers on these simple questions.

Therefore this study will be interesting not only to specialists who are investigated in the fate of dinosaurs, but also will be interesting to geophysicists, volcanologists, seismologists, astrophysics, paleontologists and other specialists, including climatologists, who could not be successful to reconstruct the paleoclimate. In this sense, this study is fundamental.

### 1.2. Sea Level

Due to our sea level data in this study is significantly above the values obtained by other researchers groups, in this section we presented and discussed the results of previous studies.

In the Cretaceous-Tertiary, the higher sea-levels above the present-day value are: 225 ± 42 m at 82 Ma after EXXON Petroleum Company [73]; 361 m at 84 Ma after [4]; 266 m at 91 Ma in [74] [75]; 242 m at 86 Ma after [5]; 79 m at 53 Ma by Miller *et al*., 2005) [76] and in the range of 85 to 270 m in the Cretaceous period (~145 to 65 Ma) after Müller *et al.* [77]. Although there is consensus concerning on the crude shape of the curve with two maxima in the Cretaceous-Tertiary and the Ordovician-Silurian, the magnitude of the fluctuation is controversial (see various models and references in [78] [79]. Later the Cretaceous eustasy sea levels maximum was updated in 2014 by Haq [80]. The average sea levels throughout the Cretaceous remained higher 75 - 250 m above than the present day mean sea level. Sea level reached two maximum, the first was in early Barremian (~160 - 170 m) and the second (~240 - 250 m), the highest peak of the Cretaceous, was in the earliest Turonian.

As it is well-known, Vail *et al.* [73] divided sea-level depositional sequences temporally into six orders ranging from tens hundreds of millions years (first-and second-order) to tens of thousands years (sixth order). First- and second-order sea level sequences were ascribed to tectono-eustatic changes in the global ocean volume, while from fourth-order to sixth-order sea level sequences were attributed to climate change within the Milankovitch frequency band. However, the third-order sea level sequences, assigned to time intervals of ~ 0.5 to 3 Ma, were interpreted as the result of climate or tectonic forcing.

According to Miller *et al.* [76] the eustasy changes in the global sea level happened due to changes in the water volume in the ocean or due to changes in the volume of ocean basins. Thus the water-volume changes are dominated by growth and decay of continental ice sheets, producing high amplitude, rapid eustatic changes up to 200 m. Other processes that affect water volume occurred at high rates and low amplitudes (5 - 10 m): desiccation and inundation of marginal seas, thermal expansion and contraction of seawater, and variations in groundwater and lake storage. Changes in ocean basin volume are dominated by slow variations in sea-floor spreading rates or ocean ridge lengths in 100 to 300 m amplitude. Variations in sedimentation cause moderate amplitude up to 60 m. Thus, an increase in the sea level of more than 300 m is not expected, see also [75] [81] [82].

The exception is Carter [78] and Watts [83], in which it was noted that on a scale of 5 - 100 Ma, the Phanerozoic sea-level cycle associated with 2nd-order sea-level fluctuations could reach 5000 m as a result of thermo-tectonic subsidence on the selected sites of the terrestrial surface. In [84], it is paid the attention to possible influence of Middle Ocean Ridge Basalts (MORBs) and Large Igneous Provinces (LIPs) on the sea level and it was cautiously suggested of 500 - 1000 m range of sea level values.

Thus, without having physical mechanism of a great sea level lifting, the researchers rather carefully express opinions about more than 300 m sea level.

## 2. Theory, Methods and Data

As the terrestrial nuclear reactor is a key element that merged together the different reasons of mass extinctions, for readers' convenience the short review of terrestrial nuclear georeactor and new recently published author's elemental buoyancy theory of the Earth is presented below.

### 2.1. Geoneutrino and Terrestrial Natural Nuclear Georeactor

As it is well-known, the crust of our planet consists of light elements, since heavy elements sank down in the melt of the magma. Thus, the presence of heavy elements in the center of the planet, such as Th, U, Pu, is entirely acceptable. Note that an idea about an existence of georeactor was discussed after Kuroda 1960 [85]. Also, the presence of Th and U heat layers in the planet center, natural nuclear georeactor and about a thermal convection in the outer core were widely discussed in the serial studies by Herndon and colleagues [86]-[91]. The possibility of natural reactor presence and possible nuclear reactions in Mars were discussed by Brandenburg, in [92].

Herndon in [86] it was demonstrated the feasibility of planetary-scale nuclear fission reactors as energy sources for the giant outer planets, three of which radiate approximately twice as much energy as they each receive from the Sun. In [87] it was written about the feasibility of a planetary-scale nuclear fission reactor in the center of the Earth as the principal energy source for the geomagnetic field and as a contribution of energy source for other geodynamic processes, such as plate movement. Herndon, in [88] suggested that an U driven georeactor with thermal power < 30 TW presents in the Earth's core and it is confined in its central part within the radius of about 4 km. In [90] it was pointed out that the georeactor numerical simulation results and the observed high $^3He/^4He$ ratios measured in Icelandic and Hawaiian oceanic basalts indicate that the demise of the georeactor is approaching. Herndon has proposed that a large drop of uranium has been collected at the center of the Earth, forming a natural 3 - 6 TW breeder reactor, so in this case, nuclear fission should provide the energy source for terrestrial magnetic field, a contribution to missing heat, and the source of the anomalous $^3He/^4He$ flow from the Earth. The results of numerical simulations of a deep-Earth nuclear fission reactor demonstrated that $^3He$ and $^4He$ could be produced by the georeactor [89].

Other aspects of natural nuclear georeactor were investigated in several studies by different research groups [93]-[106]. According to the published studies, a natural georeactor probably exists at the different deep-earth locations, including the center of the core [87] [89] [107] [108]; on the inner core boundary [100] [101] and on the core-mantle boundary [102] [104].

Also it is well-known the electrons antineutrinos that would be emitted from such hypothetical georeactor have energies above the end-point of geoneutrinos from "standard" natural radioactive decays.

The main reaction of geoneutrino (antineutrino, $\breve{\upsilon}_e$ ) registration from natural sources is the inverse beta decay reaction:

$$\breve{\upsilon}_e + p \rightarrow e^+ + n, \quad Q = 1.806 \text{ MeV} \qquad (1)$$

Using the registration of geoneutrinos, it is possible to determine a part of the terrestrial heat flux from the radioactive elements ($^{232}Th$ and $^{238}U$). It will permit to obtain the vertical distribution of these radioactive elements inside of the Earth and, accordingly, to answer the question about presence and power of a natural nuclear reactor in the center of the Earth. Details of two liquid-scintillator neutrino experiments, such as KamLAND in Japan and Borexino in Italy, in which the geoneutrino signals were measured, could be found in [100] [103] [109]-[122] and in many other publications.

However, there are some difficulties in an implementation of geoneutrino measurements, namely, a small number of inverse beta decay events were recorded per year; usually it was recorded only several hundred events per year. Therefore, the Borexino and KamLand geoneutrino experiments should continue for at least 10 years. In addition, geoneutrino measurements are hampered by a strong background from nuclear reactors and nuclear test sites, by the effect of neutrino-antineutrino oscillations in processes occurring on the Sun, as well as by the burst of supernova stars. Note, that at the small statistics it is difficult to determine stream directions of geoneutrinos from various sources.

Besides the experimental difficulties of detecting the $^{232}$Th and $^{238}$U antineutrino spectra, for calculation of the natural georeactor power it is necessary to known information about crust thickness (upper, middle, lower) and information about the vertical distribution of $^{232}$Th and $^{238}$U radionuclides inside the Earth. Usually to calculate neutrino fluxes from the Earth's interior the Bulk Silicate Earth (BSE) model or the Preliminary Reference Earth Model (PREM) of the Earth's structure were used. However, the vertical distribution of radionuclides and the model of the Earth structure also cause the numerous discussions, which significantly complicate the processing of the obtained spectra.

Thus, for a long time, it was believed that the antineutrino detection provides a sensitive tool to test the natural georeactor hypothesis; however, the difficulties with recording and processing spectra were appeared as underestimated. Also we will remind that according to geophysical data, the heat flux from the depths of our planet is equal to 44 TW by Pollack *et al.* [123], 46 ± 3 TW by Jaupart and Mareschal [124] and 47 ± 2 TW by Davies and Davies [125]. These values are much higher than the values obtained in geoneutrino experiments.

Further in [109] and in [110], it was pointed that a detailed analysis excludes a natural reactor producing more than about 20 TW, however, based on the same KamLAND and Borexino Experiments data. In 2015, the researchers of Borexino Collaboration [121] informed that the model-independent analysis yields a radiogenic heat interval that is equal to 11 - 52 TW (69% C.L.) for U and Th radionuclide decay, which be compared with the global terrestrial power output of 47 TW. Later in 2016 Borexino Collaboration restrict the radiogenic heat production for U and Th between 23 and 36 TW, but they set an upper limit for a 3.4 TW georeactor at 90% C.L. or 4.2 TW at 95% C.L. These estimations were based on the statement that geo-neutrinos are produced by the decay of radioactive isotopes present in the crust and the mantle of our planet.

However, early Rusov and colleges in [100] [103] already shown a presence of slow nuclear burning on the boundary of the liquid and solid phases of the Earth's core with georeactor of 30 TW. Therefore, Rusov and colleagues partially confirmed the theory of the author, presented in this study.

The significant difference consists of the following: $^{40}$K and $^{235}$U fuel layers cannot be determined by using inverse beta decay reactions. The lower threshold of inverse beta decay reaction is equal to 1.806 MeV, while the upper boundaries of $^{40}$K and $^{235}$U geoneutrino spectra are below this value. Thus, the $^{40}$K yield is equal to 1.311 MeV, see Equation 2:

$$^{40}\mathrm{K} \rightarrow {}^{40}\mathrm{Ca} + \mathrm{e}^- + \breve{\upsilon}_\mathrm{e}, \quad Q = 1.311\,\mathrm{MeV} \tag{2}$$

Except to neglect the decay chains of $^{40}$K and $^{235}$U isotopes, the natural reactor power calculation method also neglects the decays of $^{87}$Rb, $^{138}$La, $^{176}$Lu, $^{239}$Pu and

$^{241}Pu$.

Discussion sometimes takes forms far beyond the limits scientific knowledge. So the conflict between Herndon, the pioneer of geo reactor studying, and his NSF opponents turned into an open troublesome conflict [126]. In this study, we note that neither Herndon nor his opponents were right. The possibility of registration only minor fuel elements ($^{232}Th$ and $^{238}U$) casts doubt on advisability of carrying out the long and expensive experiments such as the KamLAND and Borexino Experiments.

Moreover, the near-surface powerful heat layer $^{40}K$ as well as Equation (2) is the basis for the revision of geophysical theories of subduction and of continents drift, as well as introduces changes in the Darwin's evolutionary theory.

## 2.2. Elemental Buoyancy Theory of the Earth Structure

The theoretical basis of this study is the newly developed theory of the internal structure of the Earth by author in [105]. This theory is based on the buoyancy of the chemical elements, which are a part of the Earth. We will shortly remind an essence of our theory.

As it well-known, the Earth's crust is composed mainly of oxides of light elements such as $SiO_2$ (59.7%), $Al_2O_3$ (15.4%), CaO (4.9%), MgO (4.36%), $Na_2O$ (3.55%), $K_2O$ (2.8%), $H_2O$ (1.52%). The exception makes only oxides of Fe (z = 26) and Ti (z = 22), which content in the crust is equal to FeO (3.5%), $Fe_2O_3$ (2.6%) and $TiO_2$ (0.6%), respectively [127] [128]. Heavy elements are absent in the Earth crust in a significant amount. Thus the geoscientists draw a conclusion that the chemical elements were separated in the melted magma and core.

From the point of view of the nuclear science, it is quite natural to assume that the gravitational field of the Earth will separate not only the chemical elements, but also will disunite terrestrial isotopes. Let's remind that the weighting of the elements inside of the Earth occurs due to the capture of neutrons. Below the equations of slow neutron capture and of chemical element transformation $^{56}Fe \to {}^{63}Ni$ are presented:

$$\begin{aligned}
&^{56}Fe + n \to {}^{57}Fe + n \to {}^{58}Fe + n \to {}^{59}Fe \xrightarrow{-\beta} \\
&^{59}Co + n \to {}^{60}Co \xrightarrow{-\beta} \\
&^{60}Ni + n \to {}^{61}Ni + n \to {}^{62}Ni + n \to {}^{63}Ni \xrightarrow{-\beta} \cdots
\end{aligned} \tag{3}$$

The alternative reactions with involving of the $^{60}Fe$, $^{61}Co$, $^{64}Ni$ and in the s-process (slow) neutron capture equations are not represented in Equation (3). Due to the s-process, it is possible to explain formation of all elements up to Z = 83. Nuclei with Z, greater than 84, do not have stable isotopes and are radioactive. Therefore, the isotope $^{232}Th$ is formed from the $^{232}Pb$ nucleus as a result of eight consecutive β decays. The initial $^{232}Pb$ nucleus formed in the r-process (rapid) and it has 24 neutrons more than the stable $^{208}Pb$ isotope. Thus, as a result of slow and rapid processes of neutron capture, there is a formation of heavy elements inside the Earth that are slowly deposited deep into the planet. More details about nucleosynthesis of the chemical elements could be found in several reviews [129]-[133].

The linear distribution of the chemical elements inside Earth at the non-perturbed state of natural terrestrial reactor ("cold" planet), according to elemental buoyancy theory, which was developed by author [105], was presented in **Figure 3**.

The decay products, which were formed in the Th-U layers, will rise up. With the decay of Th and U elements, an inhomogeneous distribution of decay products is formed, with a predominance of light and heavy decay products. Conventionally, we can assume that the peaks of the decay products correspond to such elements as Sr and Cs. According to the model, the Cs level will correspond to the level of 2860 km, which constitutes the boundary between the outer core and lower mantle; this boundary also called as Gutenberg discontinuity.

Thus, inside the Earth, both the processes of lifting up of light decay isotopes and the sink down of elements, which capture neutrons, will occur. The presence of the $^{40}K$ nuclear fuel layer defines the boundary between upper and lower mantle; the presence of heat-generating Th-U isotopes corresponds to the boundary between the inner and outer core (**Figure 3**). Therefore the Earth is a system of layers consisting of isotopes of chemical elements, which were vertically selected by the gravitational field of the Earth.

Further, it was noted that due to the existence of the hot $^{40}K$ fuel level and shallow convection in the upper mantle, the theory of subduction and continental

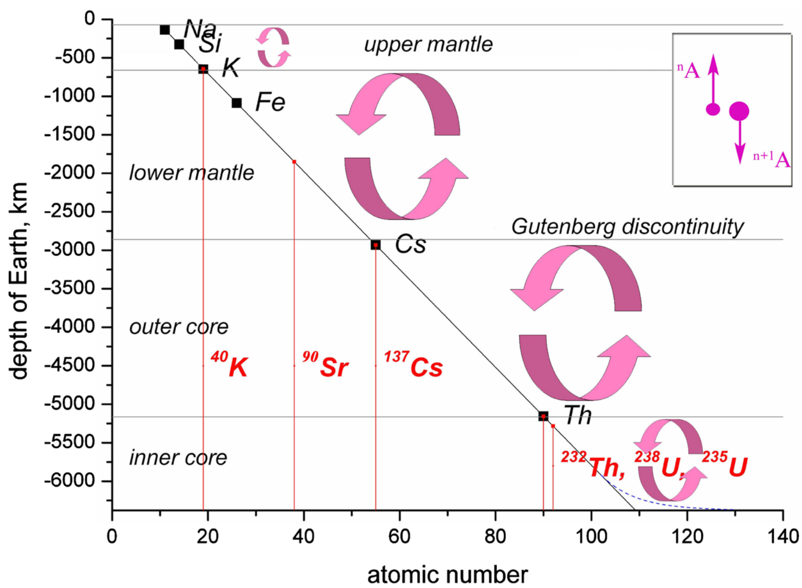



**Figure 3.** The scheme of terrestrial nuclear reactor ("cold" planet) is presented. The linear distribution of the chemical elements inside the Earth at the non-perturbed state of natural terrestrial reactor, according to buoyancy theory, (Safronov, 2016), is drawn. The red lines show the basic fuel elements, such as $^{40}K$, $^{232}Th$, $^{235}U$, $^{238}U$ and major products of decay such as $^{137}Cs$ and $^{90}Sr$. The red circular arrows show the shallow convection processes inside the Earth. The Sr decay level is degenerated in the "cold" planet. On plate: the buoyancy theory principal: the heavy element $^{n+1}A$ sinks down; the light element $^{n}A$ floats up.

drift should be revised. At the period then planet was hot, the viscosity of magma in the upper mantle was low and the probability of continent drift was more than at present. Now abstract theories of subduction and continental drift will get in the framework of the Elemental Buoyancy Theory, described above, another completely convincing physical meaning.

Thus, we have led the reader to understanding of the fact that the standard geological table is a log of the registration of galactic events, which have passed during the existence of the Earth. Such treatment is completely new; no one has previously suggested reconstruction of the structure of the galactic arms by using terrestrial geological sedimentary.

### 2.3. The Shallow and Deep Convection

Based on the model investigated in [105], at the period, when natural reactor was operated in a cool, unperturbed mode, the small convective processes dominated inside the magma and core, at which the molten masses do not leave the localization zones. The presence of nuclear fuel or product of nuclear decay at the boundaries leads to an increase in temperature and forms a thermocline or thermopause. In particular in the upper mantle in the convective process, only light chemical elements with atomic numbers up to potassium will be involved. This explains why silicon and sulfur compounds currently dominate in volcanic plumes.

A similar thermocline will be formed at the boundary of the inner and outer core, where the Th-U layers are located. As it is known, the U decay products mainly include chemical elements, which distribution has two maxima, separated by a minimum at the level of elements with atomic numbers, equal to ~50. Decay products, warmer and lighter than U, will rise approximately to $^{137}$Cs level. Since $^{137}$Cs also will form a thermocline, it will prevent the rise up of light decay products, such as $^{85}$Sr-$^{90}$Sr. In [105], it was noted that on seismograms the Sr signal is absent. Thus, the Sr element and its isotopes can be used as a marker of perturbation of the terrestrial reactor ("hot" planet) and as a marker of sea level changes. Also in [105], it was noted that the isotopes $^{85}$Sr-$^{90}$Sr had to be formed, but this level of discontinuity has not been presented in the seismic records. This means that the Cs layer forms a thermopause, which prevents the light decay elements of the Th-U decay lift up above the Cs layer. The shallow convection process places inside outer core. However, any external disturbance can lead to the destruction of this unstable equilibrium and light decay isotopes such as Sr can lift up in the lower mantle. Further, these isotopes will get into the Middle Ocean Ridge Basalts (MORBs) and into the Large Igneous Provinces (LIPs).

Also the sharp changes in $\delta^{13}$C content during the period of mass extinctions were considered in many studies, including for the Early Jurassic mass extinctions, see e.g. [134]-[138]. However, perturbation in the carbon-isotope record recovered very quickly; therefore it cannot be directly connected with the process of extinction of biological species and with process of Jurassic oceanic anoxic events. It is more likely that $\delta^{13}C$ changes are determined by tectonic processes and astronomical processes. It is necessary to specify that changes in the isotopic composition are a common process at any operating mode reactor changes.

Therefore, it is possible to make an assumption that changes happened in operating mode of CNO nuclear cycle in the upper mantle at sharp activation of the $^{40}K$ layer during period of galactic gravitational compression. Thus, sharp changes in $\delta^{13}C$ values should correlate with formation LIP, $SO_2$ volcanic emissions and lift up the heavy chemical elements from depths to upper mantle. The relations between mass extinction, $\delta^{13}C$, $^{87}Sr/^{86}Sr$ and $\delta^{34}S$ were presented in the reviews [139] [140]. Any above isotopes, it is possible to use for the characteristic of a condition of the terrestrial reactor, but we have chosen the $^{87}Sr/^{86}Sr$ ratio as a marker of a hot planet. The deep convection, taking place inside the hot planet, involves layers of upper and lower mantle.

The $^{87}Sr/^{86}Sr$ ratio during the Phanerozoic, based on [141] [142], were shown in **Figure 4** as blue and black lines, respectively. Additionally, the bold color lines indicate the stages corresponding to Triassic and Jurassic. The correlation between the reduced values of $^{87}Sr/^{86}Sr$, corresponding to periods of raised tectonic activity, and the Scutum-Crux and Norma Arms is observed. The more information about the revised $^{87}Sr/^{86}Sr$ ratio during the Jurassic could be found in [143], also see details in [144] [145] [146].

## 2.4. Thermal Compression of a Nuclear Substance

As it is known, at gravitational compression the nuclear reactions of hydrogen

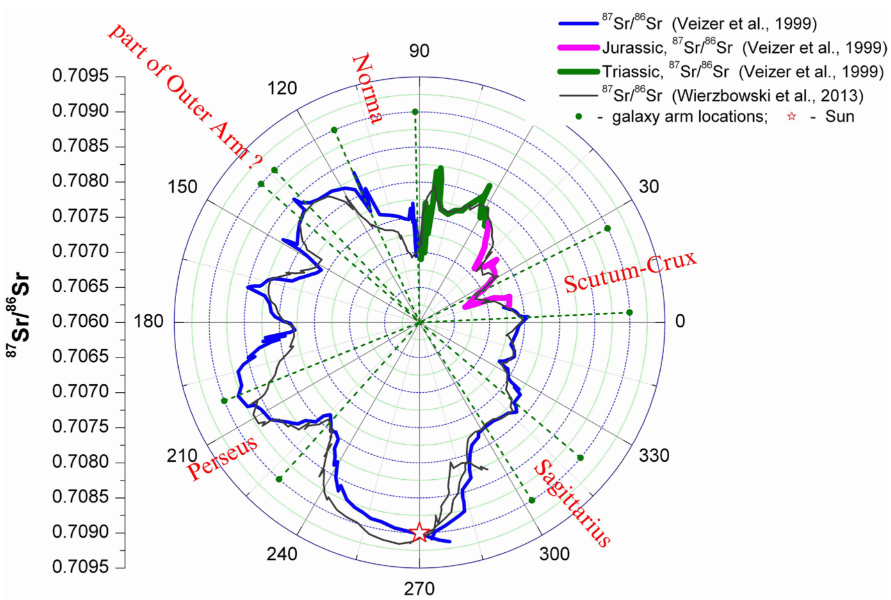



**Figure 4.** The "cold"-"hot" variability of our planet during Paleozoic. The $^{87}Sr/^{86}Sr$ isotope ratios as a marker of the activation of terrestrial nuclear reactor are presented in the galaxy polar coordinates. On Jurassic, the $^{87}Sr/^{86}Sr$ ratio is highlighted by magenta color and on Triassic—by green ones.

and helium burning are possible. The nuclear reactions of burning hydrogen are the next:

$$\begin{aligned} &{}^{1}\mathrm{H} + {}^{1}\mathrm{H} \rightarrow {}^{2}\mathrm{H} + \beta^{+} + \nu \\ &{}^{2}\mathrm{H} + {}^{1}\mathrm{H} \rightarrow {}^{3}\mathrm{He} + \gamma \\ &{}^{3}\mathrm{He} + {}^{3}\mathrm{He} \rightarrow {}^{4}\mathrm{He} + 2\,{}^{1}\mathrm{H} \\ &\text{Summary}: 4\,{}^{1}\mathrm{H} \rightarrow {}^{4}\mathrm{He} + 2\beta^{+} + 2\nu + 26.7\ \mathrm{MeV} \end{aligned} \tag{4}$$

As a result, there is a full combustion of hydrogen and its transformation into helium [130]. A feature of helium combustion reactions is that after main reaction, when two 4He nuclei merge, the second reaction occurs with the formation of an unstable $^{8}$Be nucleus. However, due to the high density of $^{8}$Be nuclei (usually at M > 0.7 Msun), before it again will break up on two $\alpha$-particles, it has time to interact with another $^{8}$Be nucleus. The process, so-called as the "triple" α-process, occurs with the formation of an excited $^{12}$C isotope:

$$ {}^{4}\mathrm{He} + {}^{4}\mathrm{He} + {}^{4}\mathrm{He} \rightarrow {}^{8}\mathrm{Be} + {}^{4}\mathrm{He} \rightarrow {}^{12}\mathrm{C} + \gamma, \quad Q = 7.16\ \mathrm{MeV} \tag{5}$$

The process of fusion of two nuclei is schematically presented on plate in **Figure 5**.

With dense spherical packaging approach, the size of chemical elements ($D$) is associated with atomic numbers ($A$) as:

$$D_A = r_0 A^{1/3} \tag{6}$$

Assuming that in the depths of the Earth's interior the element packing is spherical, the ratio of atomic sizes before and after nuclear fusion is equal to $D_A/D_{2A} = 0.63$, where $D_A$ and $D_{2A}$ are the diameters of the elements with atomic numbers $A$ and $2A$. Also, the dependencies of the degree of compression on the

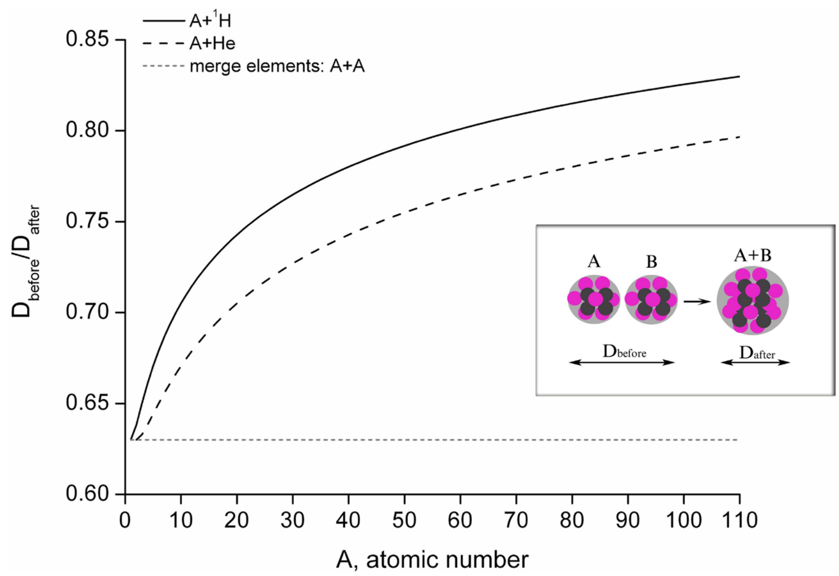



**Figure 5.** The $D_{before}/D_{after}$ ratio in the case of merging between the chemical element with atomic number A and $^{1}$H, He and in the case of nuclear burning (A + A) is shown. On plate: the principal of nuclear burning: the two nuclear substances have size less then merged ones.

element number at the fusion of $^{1}H$ and $^{3}He/^{4}He$ are shown in **Figure 5**.

Thus, unlike metals, liquids or gases, at heating the nuclear substance will be compressed and, conversely, at cooling the nuclear substance will be expanded. Note, that applied to the Sun, the effect of expansion is well-known [147]. The Sun in the future will expand and absorb the planets located not far from the star. Fundamentally new is the application of this principle to the Earth's natural reactor.

Thus, in this study in some sense, we return to the ideas of Roberto Mantovani and Samuel Warren Carey [148]-[152] in which early the possibility of Earth expansion was considered.

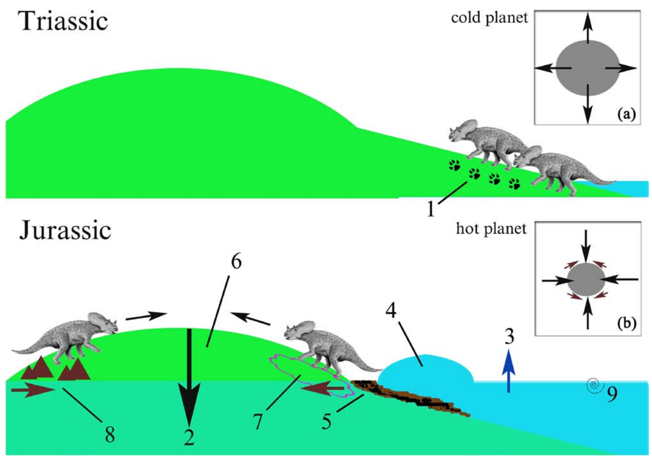
Initially soon after the formation the Earth was smaller in size, was hotter and was almost completely covered by the waters of the world ocean. Therefore, it is not surprising that the primary forms of life have arisen in the depths of the ocean. Secondly, as the Earth cools slowly, there is its gradual expansion. Accordingly, the area of the world ocean has decreased and the land area has increased. Hence, the statement that in the process of evolution the reptiles come out from ocean and clime up to land should be considered inconsistent with reality. Those reptiles, which did not have the opportunity to migrate into the depths of the ocean, were forced to adapt to life on land. Note that the process of changing the level of the ocean due to the expansion of the Earth is not monotonous and have its inner (reactor), planetary and galactic episodes. As the question of the Earth expansion as a result of its cooling is obvious, in this study we will focus on the Earth compression and on the worldwide floods resulting from galaxy compression.

## 3. The Objects of Investigation

The galaxy has heterogeneity of distribution, so due to additional galactic gravitational loads in planet evolution the natural terrestrial reactor will be regularly warming up our planet. Namely, several times per full galaxy cycle the Earth's reactor will suddenly pass from a quiet, slow-burning mode to a hot excited mode. The periods of galactic compression, except the appearance of isotopes, will be characterized by increased volcanic and seismic activities, by disturbance of the magnetic-dynamic terrestrial field, by increased solar activity, and a significant increasing in the temperature of the surface of the land and ocean.

As shown above the minimum value of $^{87}Sr/^{86}Sr$ ratio through the Phanerozoic (**Figure 5**) and accordingly maximum terrestrial reactor activation has occurred in Jurassic, therefore this period has been chosen as test polygon.

The common scheme, displaying the planet narrowing, sharp reduction of an area of overland species habitat and the dinosaur's migration, is shown in **Figure 6**. Thus, in process of planet cooling, the sea inhabitants of the sea at first turn into shallow water and then because the ocean retreated, they found themselves on a land. We will notice that the process of planet narrowing and widening occurred several times.




Numbers indicate: 1—the traces of dinosaur migration at the initial phase of the worldwide flood; 2—the sharp reduction of the planet size during activation of the terrestrial nuclear reactor; 3—the sea level has risen due to glacier melting and the sea thermal expansion; 4—worldwide tsunami; 5—mudslides at the shore and plain flooding; 6—the hill, an area of survival; 7—the mass extinction area; 8—rock hummocking (iron-shaped) at the strong Earth crust compression and at the continent drifts; 9—Ammonites floating in the upper sea layer.

**Figure 6.** On a simple diagram the worldwide flood is illustrated and the sharp reduction of dinosaur areal is presented. On plates: (a) the nuclear expansion of the Earth ("cold" planet); (b) the nuclear narrowing ("hot" planet), when Sun crossed of the galaxy disk.

At the moment there are no methods of direct measurements of the planet size in the past and we are forced to estimate the changes in the radius of the Earth by various fossils studying. By examining the depositions of terrestrial and marine fossils, we limit on both sides, above and below, the possible amount by which the radius of the planet has changed.

Making comments on Figure 6 it is necessary to tell some words about dinosaurs. The processes of planet size decline and correspondently the sea level rise will occur on a time scale equivalent to the activation time of the terrestrial nuclear layers. The sudden rise up of the ocean level will lead to a change in the habitat area of most amphibians and those marine species those do not have the ability to freely swim in the ocean, and as result to their almost instantaneous mass extinction. Note that at such rapid changes the biological species will not have any chance to adaptation. For survival the dinosaurs had to move quickly to have time to reach hills. Sharply reduction of habitat areal, of course, led to increased both inter-species and intra-species competitions. Serious advantages were obtained by those species that could easily climb up on steep rocky slopes. The worldwide floods could be a prior for the appearance of planning (flying) species of dinosaurs, which could easily flip from one rock to another.

Thus, it is necessary to find answers to next questions:

*How much can decrease the radius of the planet when terrestrial reactor warms up*?

*How fast can this process happen*?

First the spatial and temporal analysis of Saurischia dinosaurs' distribution at Jurassic was performed. To characterize the lower boundary of the sea level, the fossils of the Jurassic vegetation (Plantae species) also were used, without gradation in genus and species. To characterize the upper limit of the sea level, the distributions of Ammonitida, Nautilida and Pectinida, which lived basically in coastal waters, were used. Let note that Ammonitida (phylum: Mollusca, class: Cephalopoda) lived from the Jurassic through the Cretaceous time periods. The Ammonitida had an outer shell, consisting of several turns, located in the same plane. The ammonite shell is divided into several chambers, which were supposedly filled with gas that allowed supporting buoyancy of the majority of representatives of this species of mollusks.

The Ammonitida sizes are various in diameters from a few centimeters till 2 m, such as Parapuzosia seppenradensis. The Nautilida (phylum: Mollusca, class: Cephalopoda) is the second mollusk that was used in this study. The Nautilida began in the mid Paleozoic and continues to the present. Note that only a single genus, Cenoceras, with a shell similar to that of the modern nautilus, survived the less severe Triassic extinction, at which time the entire Nautiloidea almost became extinct. Also, the distribution of Pectinida was analyzed. These subspecies of mollusks represent a large family of marine bivalve mollusks. The Pectinida attach by their byssus to the substrate or freely lie on the ground; this species of mollusks live mainly in shallow waters, which permit to estimate the sea level more accurately.

The general information about evolution of dinosaurs can be found in many references including [153] [154]. The coordinates of the sites where the fossils of Saurischia, Plantae, Ammonitida, Nautilida and Pectinida sites was defined from The Paleobiology Database, below *PaleoDB* [155]. The temporal distribution of fossils was analyzed with 3 Ma intervals; whereas the altitude distribution was analyzed with 100 m intervals. The ETOPO1 topography with a 1 × 1˚ spatial resolution was used as a topographic base.

## 4. The Results of Statistical Analysis

### 4.1. Mass Extinctions in Jurassic

First we will show in Jurassic the correlation between mass extinction of land dinosaurs, blossoming of sea fauna and terrestrial nuclear reactor activation. The temporal distribution for Saurachia and Ammonitida, obtained by the PaleoDB, was presented in **Figure 7(a)** & **Figure 7(b)**. The reducing segment in the $^{87}Sr/^{86}Sr$ ratio in **Figure 7** is related to the period of terrestrial nuclear reactor activation and to the perturbations in the mantle-core structure (“hot planet”).

As one would expect the amount of Ammonitida fossils is in an antiphase with extinction of land dinosaurs. In the small warm seas which occupy the big areas during the period of “hot planet”, the Ammonitida have quickly reproduced at III, IV, VIII and IX of Jurassic stages. Note that the sharp dinosaurs’ extinction happened at I - III stage (Hettangian-Pliensbachian), which is corresponding to the first Jurassic flood. Below for simplicity of consideration at the altitude analysis, we will be limited to this period, 201.6 - 190 Ma.

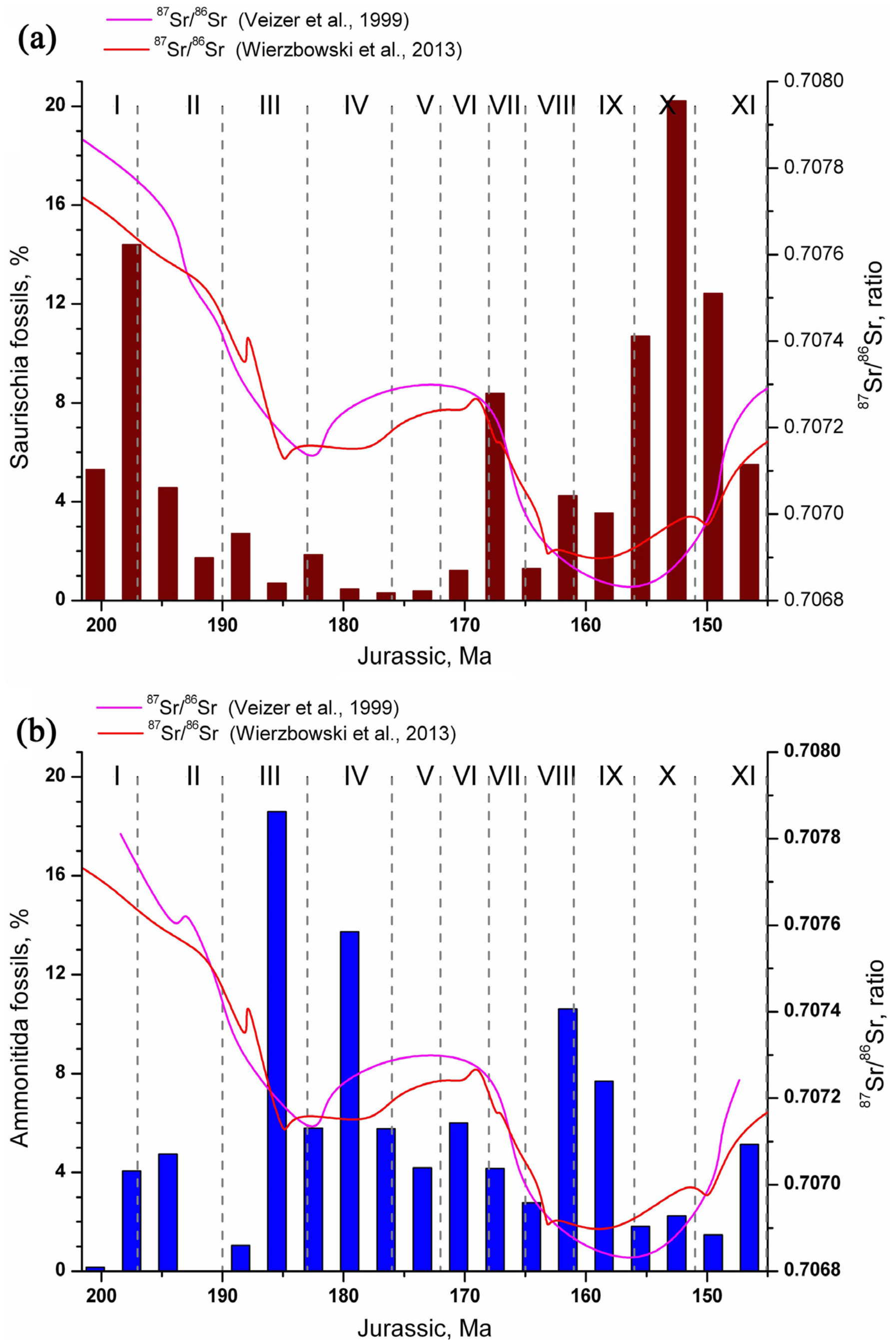



**Figure 7.** The statistical temporal distributions of dinosaurs Saurischia (a) and Ammonitida (b) at I - XI standard Jurassic stages. The $^{87}Sr/^{86}Sr$ isotope ratios are shown in addition, (Veizer *et al.*, 1999), (Wierzbowski *et al.*, 2013) and (Wierzbowski *et al.*, 2017).

## 4.2. Altitudes Distribution of Fossils in Early Jurassic

It is of interest to investigate in detail the result of statistical analysis of the altitude distribution during the first Jurassic flood, at I - II stages (Hettangian and Sinemurian). The fossil coordinates have been projected on the ETOPO1 map. The received values of Ammonitida, Pectinida, Nautilida and Saurischia altitudes are presented in Figure 8.

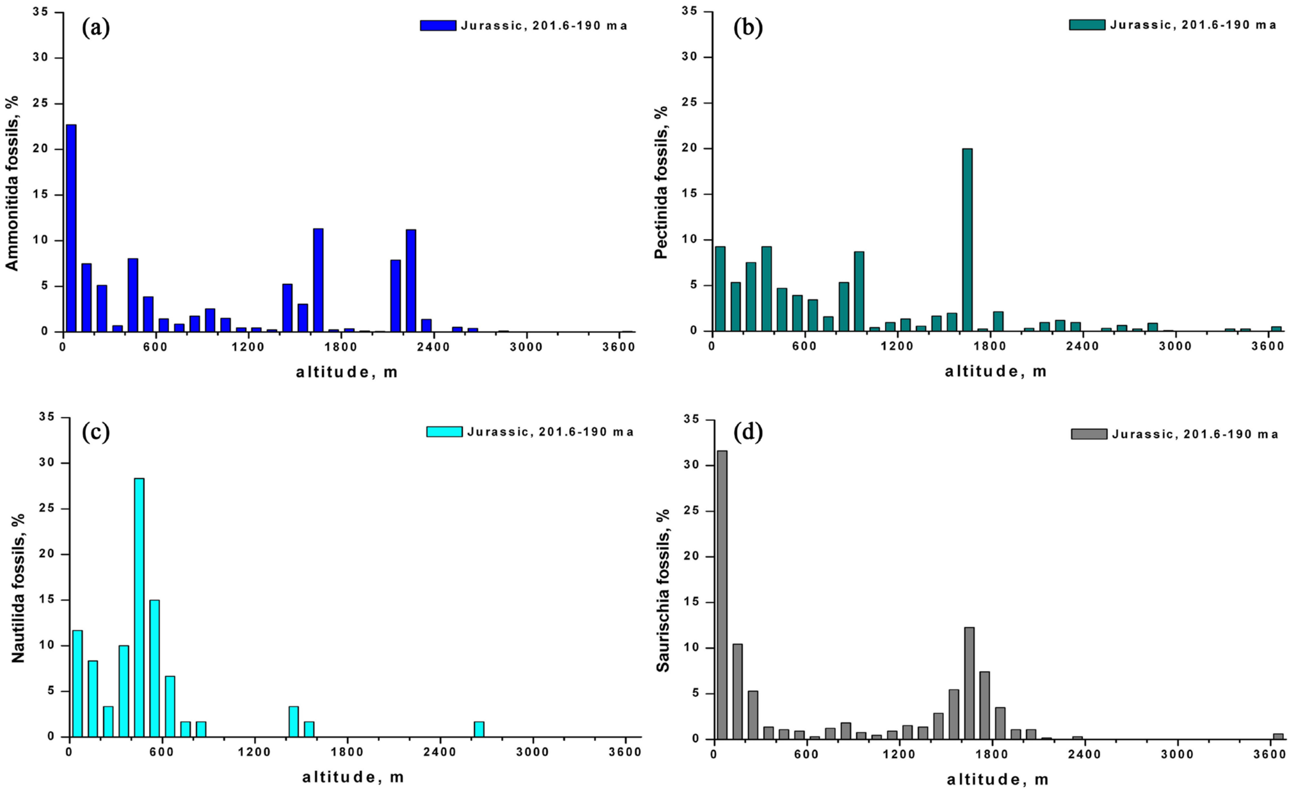



**Figure 8.** The statistical altitudinal distributions at Early Jurassic, 201.6 - 190 Ma for the sea inhabitants are presented: Ammonitida (a), Pectinida (b) and Nautilida (c), and for the land inhabitant: Saurischia (d).

The distribution shows a bimodal character in Figure 8(d), which means either the presence of two dinosaurs' populations or the altitudinal migrations of dinosaurs. Below it will be shown that such a distribution is a result of dinosaurs' migration during the global floods. As it is possible to see from this distribution (Figure 8), the significant part of dinosaurs escaped from the flood at altitudes of 1600 - 1800 m. Also from marine distributions it can be seen that sea mollusks at the first Jurassic worldwide flood lived at altitudes of 400 - 600, 1400 - 1600 and 2200 - 2300 m, Figures 8(a)-(c). Thus, the structure at the first Jurassic worldwide flood period was heterogeneous and there were at least three flood waves with heights of 400, 1600 and 2200 m. Note that heights of ~1600 m presented in both Ammonitida and Pectinida distributions (Figure 8(a) & Figure 8(b)).

Since the maximum for shallow-water Pectinida practically coincides with the maximum of Saurischia, it is possible to assert that most dinosaurs preferred to live at the sea beaches. At the same time, of course, it is impossible to exclude possibility that all these dinosaurs died at the sea shore due to the giant tsunami caused by tectonic changes. The sea sediments and mudflow, raised by the tsunami, could create favorable conditions for the conservation of dinosaurs' fossils and marine inhabitant shells.

Also, as it can be seen from the Ammonitida distribution, there is still a maximum at 2200 m, while the corresponding maximum in the dinosaurs' distribution is practically degenerate. At these heights, a minor maximum of double-clam mollusks was observed. Therefore, the dinosaurs either could not climb to heights of 2100 - 2200 m, or they did not have time to do it, while the well-floating Ammonitida could easily be pushed up at such altitudes by water streams. Further, to show that the given estimations of sea level changes and accordingly of reduction of planet radius are not artifacts it is of interest to investigate the spatial distribution of dinosaurs' fossils and to define the circumstances of their death.

## 5. The Galactic Rescue Bases

The investigation the spatial distribution of dinosaurs' fossils and define the circumstances of their death are directly linked with creation of galactic rescue bases on the Earth. Such rescue bases should be created in those places where the dinosaurs tried to escape. The spatial distributions of fossils were analyzed and visualized by using the modern ArcInfo GIS system. A description of this GIS system could be found at site: https://www.esri.com/en-us/home. All coordinates below are presented in modern system of coordinates, as they are presented in PaleoDB.

As this paper is not studies of paleontology we will be limited our text to studying particular cases of dinosaurs' tracks in South Africa and North America.

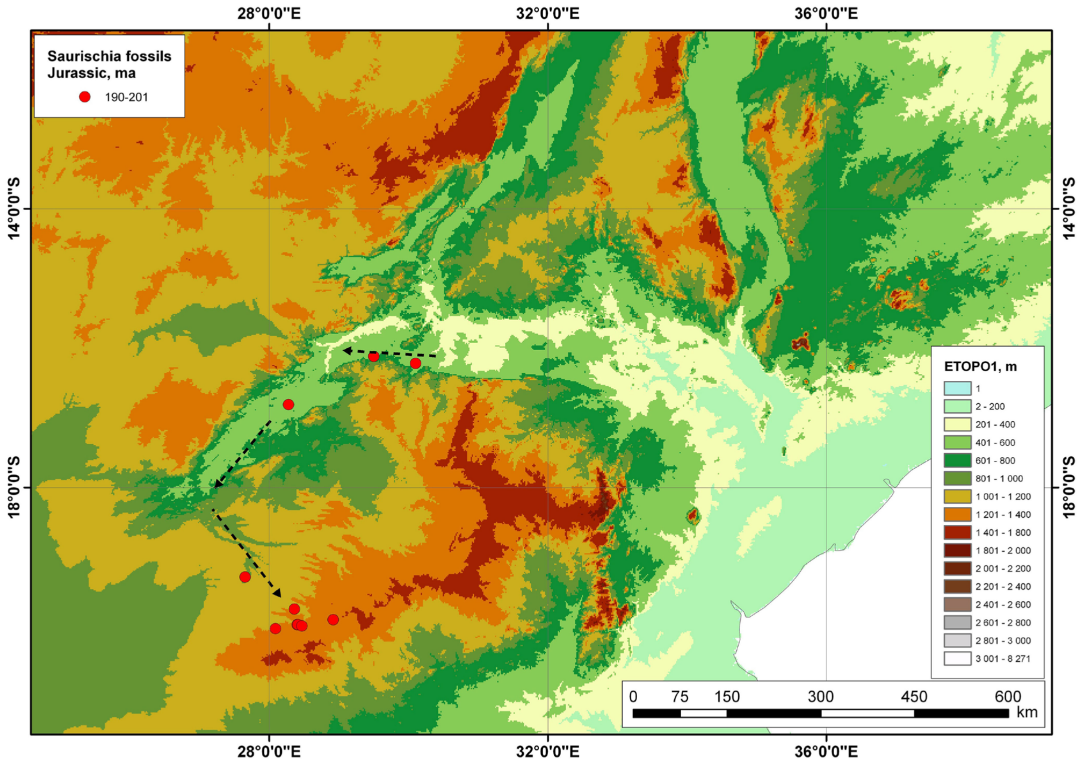
### 5.1. The Saurischia Fossils in the South Africa

The Saurischia migration path near the east coast of South Africa and fossil locations are shown in **Figure 9(a)** & **Figure 9(b)**. In both cases, the dinosaurs moved in the canyon, first to the west, then turned to the south-east and climbed up on the plateau. According to **Figure 9(a)** the maximum height, in which fossils were found, is equal to 1323 m. At high altitudes, the remains of Thecodontosaurus and Massospondylus have been identified. The approximate dating of dinosaurs' death is ~195.7 ± 5.4 Ma.

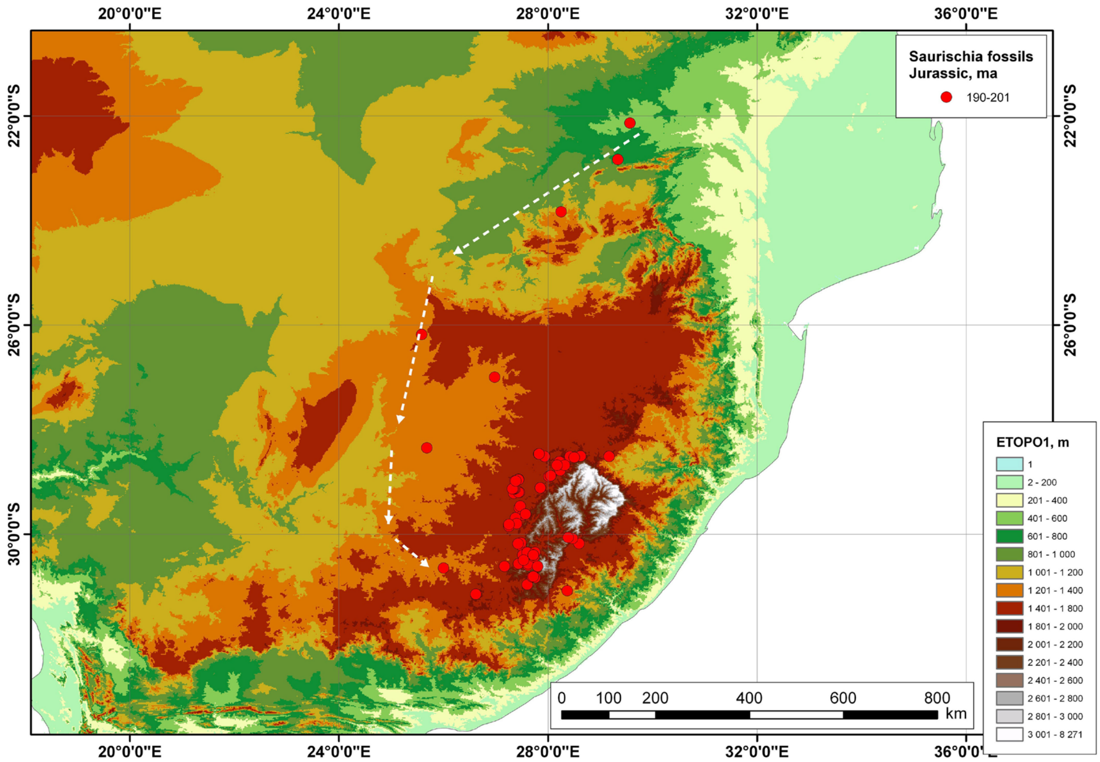
Further, according to **Figure 9(b)**, in second area in South Africa the maximum altitude, where the fossils were found, is equal to 2032 m. At high altitudes, the remains of the Massospondylus, Melanorosaurus and Syntarsus have been identified. The approximate dating of their death is ~195.8 ± 4.9 Ma. In spite of the fact that both areas separated from each other on considerable distance the general behaviors of dinosaurs are similar. It is expressed in aspiration to rise above 1400 - 1800 m.

### 5.2. The Saurischia Try to Be Safe in the Lagoons in the North America

The analysis showed that dinosaurs repeatedly tried to escape in isolated lagoon systems that were located in the middle of the world-wide oceans. An example of such a lagoon system is the mountain ranges nearby the west coast of North America. The distributions of Saurischia fossils in this lagoon at the first (201 - 190 Ma) and at the second Jurassic flood (168 - 160 Ma) are shown in **Figure 10(a)**




(a)




(b)

**Figure 9.** The Saurischia tracks and fossils (201 - 190 Ma) is presented near the fault that corresponds to the two parts of modern east coast of the South Africa. The topography is ETOPO1. The movement of dinosaurs occurred along the spurs of the gorge with a rise to heights of 1200 - 1400 m. The altitude of the virtual ocean level corresponds to the beginning of the first Jurassic flood, ~ 0 m asl (above present sea level).

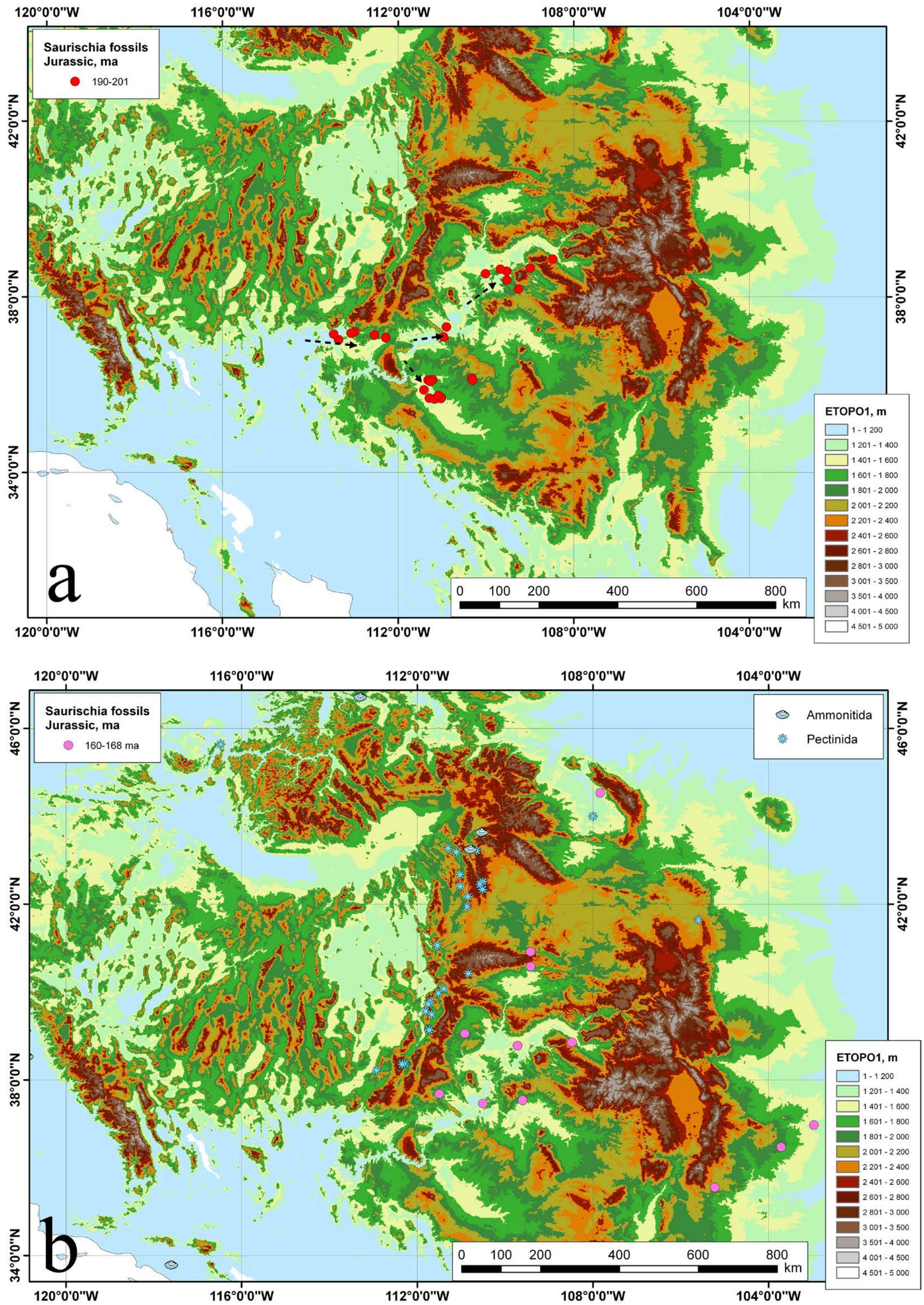



**Figure 10.** The spatial distribution of Saurischia near the fault, corresponding to the western coast of the North America for two periods of maximum sea level rise at 201 - 190 Ma (a) and at 168 - 160 Ma (b), are presented. The altitude of the virtual ocean level corresponds to ~1200 m asl. The migration of dinosaurs took place up the canyon into the high-mountain lagoon, which is the ideal place to save the population, (a). The marine inhabitants form long reef in coastal waters along the outer edge of the lagoon, (b). According of marine inhabitants' locations, the altitude of the worldwide flood at 168 - 160 ma could reach values of 2000 - 2200 m.

and Figure 10(b), respectively.

During the first Jurassic flood, dinosaurs climbed up into canyon to the high–mountainous lagoon, which is the ideal place to preserve the population, Figure 10(a). The storms of the Jurassic World Ocean did not reach these places; the waves were breaking on the ridges surrounding the lagoon. The lagoon was connected to the World Ocean through two narrow canyons, which mitigated changes in sea level. At high altitudes, the remains of Kayentapus, Otozoum and Dilophosaurus were identified. The maximum height for finding tracks and fossils is equal to 2001 m. The approximate death date is ~193.7 ± 6.2 Ma. The Saurischia tracks in lagoons are clearly visible, Figure 10(a).

A similar picture of the Saurischia distribution in the lagoon at second Jurassic flood, 168 - 160 Ma is shown in Figure 10(b). The difference between these two analyzed cases is that some of the remains are found outside the lagoon. In the second case, the Saurischia tracks in lagoons are not clearly recognized, Figure 10(b). For obvious flooding, the spatial distribution of Ammonitida and Pectinida is additionally shown. These mollusks formed a characteristic reef on the north-western side of the lagoon. Ammonitida fossils were found at heights of 2160 m (164.8 Ma). The Pectinida fossils were located at altitudes of 2394 m (167.2 Ma), 2040 m (164.5 Ma) and 1440 m (160.4 Ma). The maximum height of the Saurischia remains is equal to 1952 m. At high altitudes, the remains of the Therangospodus, Megalosauripus, Carmelopodus and Brontopodus have been identified. Approximate dating death is ~161 Ma. Thus, the sea level during the second Jurassic flood was significantly higher than that in first Jurassic flood (1200 - 1800 m).

Therefore, the dinosaurs of North America successfully escaped in mounted lagoon during the all Jurassic period, in other words this lagoon is a kind of the "Noah Ark" preserving the variety of terrestrial species in North America during the worldwide floods. Contrary to successful escape events the unsuccessful attempt of dinosaurs escape occurred on the east coast of the North America (Figure 11).

In this case, the dinosaurs' trails are well-known due to their prints left on the ground. The height of these hills is approximately 600 - 800 m. According latitude-longitude projection on ETOPO1, the maximum height for footprints on trail was recorded at altitude ~144 m. The soil composition at the excavation places was mixing of sandstone, mudstone and "shalle" (pebble). The approximate dating of the tracks and remains is equal to ~197.3 ± 4.0 Ma, which corresponds to the initial period of the first Jurassic worldwide flood, which had 400 m of altitude. As the hill heights are insignificant, it is not surprising that dinosaur fossils, dating at subsequent Jurassic periods, were not found in this region.

Summarizing all, we can conclude about the transience of the flood processes, after which the system slowly returns to its original state, that is, we are dealing with a pronounced sawtooth-shaped process. The maximum length of migration routes is equal to ~700 km. Assuming that dinosaurs moved at a speed of about

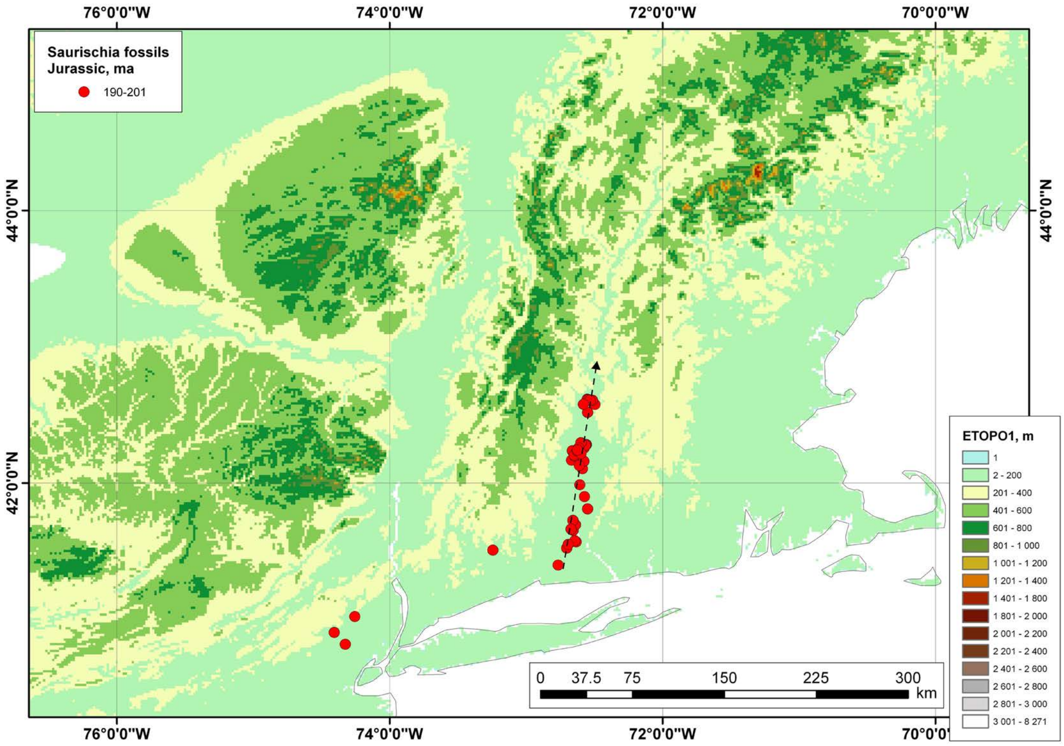



Figure 11. The path of Saurischia trace (291 - 190 Ma) is presented near the geological fault that corresponds to the modern east coast of the North America. The altitude of the virtual ocean level corresponds to the beginning of the first Jurassic flood, ~0 m asl.

1 - 3 km/h, we get that the first Jurassic flood fill huge area in a record short period in range of 10 - 30 days. Note that the Sun and our planet Earth in the future will entered into the zones of gravitational compression, therefore it is necessary to plan in advance creation of galactic rescue bases. North America and Tibet plateaus, rising above sea level to altitude more than 2500 m, are an ideal place to create such a galactic rescue bases.

## 6. Conclusions

In this work, the reasons for mass extinction during Jurassic were investigated. The simple and natural explanation for the extinction of species by the rapid worldwide flooding of a significant part of the Earth's surface and by the occurrence of giant waves of tsunamis is proposed. It is suggested that mass extinctions on Earth occurred at that period when our star passed through the area of Milky Way Galaxy Arms.

The galactic compression led to the activation of the natural nuclear reactors inside the Sun and the Earth, which follow-up led to a change in solar activity, tectonic activity, volcano eruptions, LIPs, MORBs, in planet temperature rising, drift continents, narrowing Earth, worldwide floods, tsunami, change terrestrial magnetic fields and distribution of sedimentary isotopes. In this study, we consider the process of narrowing Earth at the time when Sun star passed through the Scutum-Crux Arm, which corresponds to the Jurassic geological period.

The problem of mass extinction can be solved only within the framework of joint consideration of several areas of knowledge, namely astronomy, nuclear physics, geology, volcanology, paleoclimatology and paleontology, and accordingly it cannot be resolved within only one of these sciences.

Note that on the one side acknowledgment merging from astronomy, nuclear science, geosciences and paleontology give us the wide view on nature and understanding the interactions between different processes, but on the other side such design of the study has limitations in presentation of details of these processes. In particular, the analysis of spatial distribution of fossils was limited only by some events in Africa and North America in Jurassic.

***The main results of this study***:

*r*1. *In life science*/*astrobiology*:

During future worldwide floods, it is necessary to consider of dinosaurs' experiences to rescue. It was proposed to create bases for the regeneration of mankind and other biological forms of life on elevated terrain. First of all such space rescue base should be built on the plateau of Tibet. The Tibet area has no tectonic faults and volcanic craters. The alternative bases should be built in those places, for example in the North America, wherein the Jurassic the dinosaurs were trying to escape from the worldwide floods.

We recommend building space rescue stations at the altitudes above the recorded marina fossil levels. Due to the data of dinosaurs' migrations shows that activation speed of the terrestrial nuclear reactor is very high, it is necessary to build the rescue stations in advance.

*r*2. *In astrophysics*:

In this study, it is shown that the reduction of the planet size at galactic loading is proved due to warming up of terrestrial nuclear layers and changes in the planet inner structure. It is shown that the standard geological table is a log of registration of galactic events that have passed during the existence of the Earth. It is offered to restore the galactic arms structure by the geological deposits of the Earth. It is especially relevant for that part of the galaxy, which is located in the galactic shadow region, which is invisible for observations from the Earth.

*r*3. *In geophysics*:

In more details, than in [105], the new geological model of the Earth is presented. In this study, the simple explanation for the presence of boundaries in the structure of the Earth is given: the $^{40}K$ nuclear layer corresponds to the boundary between upper and lower mantle; $^{137}Cs$, which is the decay product of the Th-U layers of the terrestrial natural reactor, corresponds to the boundary between the lower mantle and the outer core; Th-U nuclear layers form the border between outer and inner core.

Due to the presence of a fuel nuclear layer of $^{40}K$ at depths of ~600 km, the earlier abstract theories of subduction and continental drift obtained understandable and obvious physical meaning. It is shown that when our star passes through the arms of the galaxy, the activation of the Th-U layers of the natural reactor occurs due to galactic compression. Then the activation of the Th-U layers leads to the destruction of the thermopauses and to the change in the shallow convection scheme to a deep convection, which involves in convection all layers of the core and mantle.

As a result, the volcanic eruption deposits and marine sediments change isotopic composition, also the heavy elements, which were previously held by thermopauses at great depths, float to the Earth surface. It is proved that at activation of the terrestrial nuclear layers, the planet is narrowing, which leads to worldwide floods.

*r*4. *In paleontology*:

It is established that mass extinctions occur during climate changes, global floods and Earth narrowing, which caused by galactic gravitational compression and by activation of natural nuclear reactor. It is shown that the temporal distribution of dinosaurs (Saurischia) and mollusks (Ammonitida, Nautilida and Pectinida) correspond to the periods of the first and second Jurassic floods and periods of the distributions of $^{87}Sr/^{86}Sr$ reduction. The statistical analysis shows that the average altitude distribution has a bimodal distribution and corresponds to dinosaurs' migrations from the plains to the elevations. Due to the features of warming and cooling processes of the terrestrial natural reactor, the level of the sea has a pronounced sawtooth-like character. It was defined that each of the two Jurassic floods consisted of separate episodes of flooding.

It was shown that the entrance of sea inhabitants on a land is caused by two processes: the first global process covering the all period of Paleozoic and associated with the general slow planet cooling and the second local processes characterized by sawtooth changes in sea level during the period of galactic compression. It has been suggested that the origin of flying dinosaurs is caused by adaptation of dinosaurs at the worldwide floods to small survival aerials, the poor vegetation growing on mountain slopes, and the advantages of flying in mountain district. The requirement to paleontology, consisting of the mandatory recording of the actual altitudes of the fossils, is formulated.

It is possible to express the hope that in a course of co-investigations, such as sampling of the $^3He/^4He$ on the Moon, during analyzing entrapped inclusions in the diamonds, or analyzing of $^{11}B$ in the sediments, it could be obtained some additional evidences to my hypothesis.

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The spatial distribution of Saurischia, Plantae, Ammonitida, Nautilida and Pectinida fossils are archived in the Paleobiology Database (PaleoDB) and are available to download online (https://paleobiodb.org/navigator/). The Milky Way Galaxy arms image called as "*The NASA image of the Milky Way Galaxy*" are produced by the NASA/JPL-Caltech/R. Hurt (SSC/Caltech) and are freely available online https://solarsystem.nasa.gov/resources/285/the-milky-way-galaxy/. The topography with a 1 Arc-Minute Global Relief Model spatial resolution (ETOPO1)

was created by the National Geophysical Data Center, NOAA and was available to obtain online (http://www.ngdc.noaa.gov/mgg/global/relief/).

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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