THE GRAVITY THEORY OF MASS EXTINCTION **by John Stojanowski**

ABSTRACT: The cause of mass extinctions is a subject that has been debated for well over a hundred years. Currently, the two prime suspects are bolide impact and volcanism, specifically flood basalt eruptions referred to as Large Igneous Provinces (LIPs). Bolide impact has only been associated with one of the Big Five mass extinctions at the end of the Cretaceous Period whereas four of the Big Five mass extinctions have unquestionably been associated with LIPs as is the case for other major extinctions.
Based upon the above, volcanic association with mass extinction is hypothesized to have had its lethal effect via global warming, global cooling, anoxia and hypoxia. However, the problem with the volcanogenic extinction hypothesis is that the onset of eruptions in the mid-Phanerozoic eon slightly postdates the main phase of extinctions.[09,14]
This paper introduces a third theory to explain the mass extinctions, the Gravity Theory of Mass Extinction (GTME)[01], which is able to explain the primary cause of the extinctions, which is not volcanogenic and not the result of bolide impact. It is also able to explain why LIPs are associated with most of the extinctions as well as geomagnetic reversals and massive changes in sea-level. In addition, it offers a reason why a bolide impact occurred near the end of the Cretaceous Period.

1.0 INTRODUCTION

The GTME is a radical new theory that provides an alternate explanation for the cause of mass extinctions and answers many scientific questions related to mass extinctions, megafauna and geomagnetism that have not been adequately addressed:

1. Why megafauna have appeared on Earth, from the Carboniferous through the Tertiary Periods as well as the Pleistocene epoch and why they have disappeared.
2. Whether almost all mass extinctions are initiated primarily by a single phenomenon.
3. Why massive sea-level changes have occurred throughout the Phanerozoic eon, particularly regressive-transgressive couplets, and why they accompany almost all mass extinctions.
4. Why massive flood basalt volcanic eruptions (i.e., LIPs) accompany almost all mass extinctions and why they have gradually diminished in size and intensity since the Mesozoic era.
5. Why negative carbon isotope excursions accompany almost all mass extinctions.
6. Why geomagnetic polar reversals occur.
7. Why geomagnetic secular variation occurs.

All of the above phenomena are related according to, and explainable by, the Gravity Theory of Mass Extinction (GTME) and the underlying cause of all of them is the same: the periodic oscillation of the Earth's core elements away and toward Earth-centricity. This results in fluctuations of surface gravity on part of the Earth and accounts for all seven of the above phenomena.

2.0 THE BASIC CONCEPT OF THE GTME

The GTME was first published in 2004 and has been expanded upon through 2011 and is described in several media.[01,02] The underlying principle is that one or more of the Earth's core elements (inner core, outer core and densest part of the lower mantle) can, and did, move away from Earth-centricity.

The scientific principle that permits this to happen is based on the Law of Conservation of Angular Momentum.

An example of this law, which is frequently cited, is the spinning skater that moves its arms away and then closer to its body varying its rotational velocity, and in the process, conserving its angular momentum. In other words, the skater is moving part of its mass, i.e., its arms, away from and then closer to its rotational axis. This same phenomena applies to the spinning Earth. When mass on the Earth's surface, either tectonic plates or water that eventually migrates to the North or South poles forming glaciers/ice caps, moves to a higher latitude its center of mass moves closer to the Earth's rotational axis. And, when surface mass moves to a lower latitude toward the equator its center of mass moves further away from the rotational axis. When either of the above two movements of mass occurs, the Earth's angular momentum is conserved not by a change in the Earth's rotational velocity as was the case with the skater but with movement of the Earth's core elements away from or toward Earth-centricity.

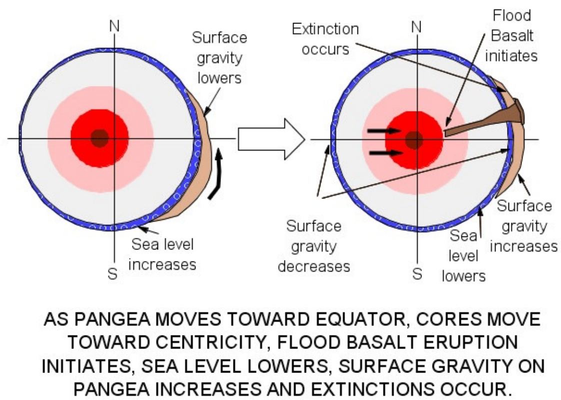

FIG. 1 When Pangea's center of mass moves toward lower latitude surface gravity increases on Pangea, extinction occurs, flood basalt volcanism initiates at the core- mantle boundary, sea level lowers near Pangea.

The displacement of one or more of the core elements from Earth-centricity causes the following changes to the Earth as shown in Fig. 1:

1. Surface gravity lowers on the part of the globe furthest away from the displaced core element(s) and increases commensurately antipodal to the area with the lowest surface gravity; a gravitational gradient develops around the globe. When the net center of mass of the Earth's surface mass moves toward an equatorial position, (i.e., to lower latitude), core element(s) move toward Earth-centricity and surface gravity around the globe returns toward equability.

2. Sea level rises in the area with lower surface gravity and lowers antipodally. Clearly, the magnitude of the sea level rise is directly dependent on the magnitude of the core element displacement. A drop in sea-level occurs when core displacement is reduced and is associated with most mass extinctions.[03,04]

3. Very large negative carbon isotope excursions (δ13c) occur during mass extinctions because the three factors that are conducive to their development are:

- A major drop in sea level as explained above. This lowers the water pressure on the methane hydrates at the sea bottom.
- Lower surface gravity (than exists today) further lowers the water pressure because the strength of gravity affects water pressure per unit depth.
- Warm ocean temperature, which existed for most of the Paleozoic and Mesozoic eras.

Volcanogenic effluents, primarily CO_2, are often cited as the warming agent that ultimately caused the negative carbon isotope excursions but they cannot account for the size of the excursions, only methane disassociation from hydrates can account for the magnitude of the excursions.[06,14]

4. When the displaced core elements move back toward Earth-centricity when the surface mass moves to a lower latitude they frequently initiate a lava plume at the core-mantle boundary which eventually manifests as a flood basalt eruption at the Earth's surface creating what is known as a Large Igneous Province (LIP). According to the GTME, the lava plume is the result of the molten outer core flow in a constricted space when the inner core is not centrally disposed within the outer core. The higher velocity flow in the narrowest space between the two cores causes a high thermal transfer at the outer core/lower mantle boundary initiating the plume. The highest thermal transfer is on the outer core's equatorial plane at the narrowest space between the inner and outer cores. The magma transit time from the core-mantle boundary to the Earth's lithosphere is directly dependent upon the velocity of the core element(s) return movement toward Earth-centricity, which in turn is dependent upon the latitudinal velocity of the surface mass moving toward lower latitude.

5. Also, when the displaced core elements move back toward Earth-centricity, specifically when the inner core moves relative to the outer core, a geomagnetic polar reversal is more likely to occur due to the asymmetrical flow of the molten iron fluid within the outer core, disturbing the dipolar magnetic field.

6. In the same way that geomagnetic reversals occur, geomagnetic secular variation follows the same process but on a much smaller scale which is not sufficient to cause a geomagnetic reversal or excursion. Several factors are responsible for the Earth's core movement including tectonic plate movement as explained previously, formation and melting of high latitude glaciers/ice caps and to a much smaller degree, possibly ocean currents and earthquakes.

3.0 MEGAFAUNA EVOLUTION AND EXTINCTION

Megafauna have evolved and disappeared during the Phanerozoic eon many times. They appeared consistently when massive tectonic plates on the Earth's surface moved to higher latitudes. Fig. 2 is a chart derived from a 2011 research paper[07] entitled '*Plate tectonics may control geomagnetic reversal frequency*' which graphically describes this latitudinal movement of Pangea when it was consolidated and then split apart through the last 320 Ma. A second graph has been added to indicate the periods when megafauna existed during the same time frame. The two graphs are very similar in shape and support the GTME's basic premise that surface gravity on Pangea lowered as Pangea's center of mass moved to a higher latitude, which would account for the evolution of megafauna. Note that the referenced graph of the research paper is based on the latitudinal estimate of continental surface area which approximates continental surface mass, upon which the GTME is based. Error bars are not shown in Fig. 2.

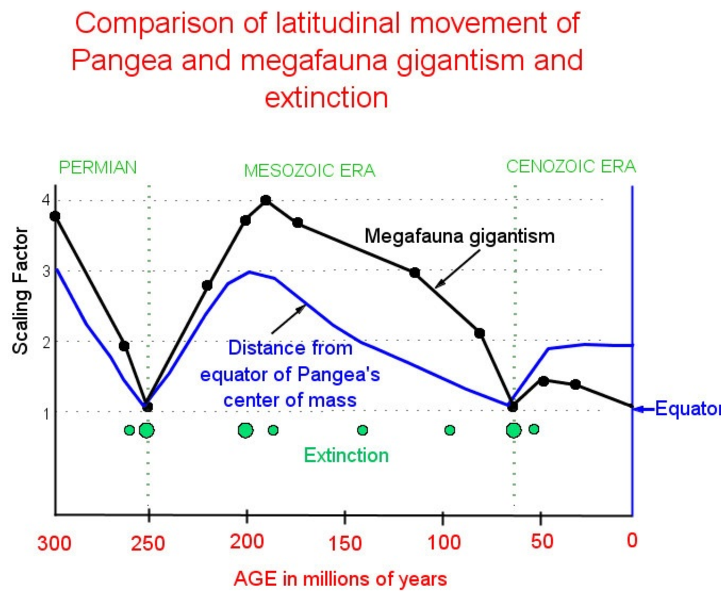

FIG. 2 Temporal relationship between estimated megafauna gigantism (black line) and latitude of center of mass of Pangea for the last 320 Ma. (blue line-graph derived from *'Plate tectonics may control geomagnetic reversal frequency',* Scotese reconstruction.

Megafauna, including the dragonfly Meganeura with a two foot wingspan (~305-299 Ma), the large semi-aquatic crocodilian phytosaurs (~228-199 Ma), the massive dinosaurs including sauropods (~160-66 Ma) and the massive terrestrial mammal Paraceratherium (~34-23 Ma) thrived when the center of mass of the Earth's tectonic plates was at a higher latitude than it is today, that is, when the Earth's center of continental mass was not situated on or very near the equator. The GTME posits the lowest surface gravity on Pangea during the Mesozoic era occurred about 201 Ma. Dinosaurs attained their maximum size much later because the crocodilian phytosaurs, the crurotarsi, held them in check. The crurotarsi, the terrestrial large-bodied splayed-leg crocodilians became extinct at this time because the pulse of increasing surface gravity made their splayed-leg body plan unworkable. Ammonites and labyrinthodont amphibians were severely affected by the surface gravity pulse at this time.

Likewise, the Pleistocene megafauna evolved after a massive quantity of ocean water was transferred to high latitude, both north and south, polar regions where it formed ice caps/glaciers causing, according to the GTME, core element displacement away from Earth-centricity in the same manner that tectonic plates did when they moved to higher latitude. The lowered surface gravity in a wide longitudinal sector on the globe which was determined by the longitudinal and latitudinal spatial distribution of the ice caps relative to the Earth's axis.[02] The location of this longitudinal sector varied as the distribution of ice in the polar regions changed; this accounts for the megafauna appearance and disappearance at different times around the globe during the Pleistocene epoch. During the interglacial periods when the polar ice melted distributing water to lower latitudes megafauna extinctions occurred, as would be expected based upon the GTME because a longitudinal sector that had low surface gravity would experience higher surface gravity as the cores moved toward Earth-centricity. Recent research[08] indirectly supports the hypothesis that climate change has played the dominant role in Pleistocene megafauna extinctions; extinctions occurred during the interglacial, (i.e., interstadial), periods but not during the glacial, (i.e., stadial), periods. However, unlike the current hypothesized climate change cause of the extinctions the GTME posits that the extinctions were caused by the warming interglacial intervals melting the polar ice caps resulting in surface mass, in the form of melt-water, moving to a lower latitude. Therefore, it was not the local change in temperature that caused the extinctions. The supporters of the human hunting hypothesis point out regions that had no significant climate change where extinctions had occurred. The temperature increase that caused the polar ice caps to melt was the catalyst for the polar ice-melt/core element movement sequences resulting in regional increases in surface gravity causing megafaunal extinctions.

During mass extinction periods dwarfing of both marine and terrestrial taxa has occurred. MacLeod (2015) in reference to the Late Triassic extinctions notes that there is evidence of differential selection against large, complexly coiled ammonites.[09] Likewise, Gerta Keller and Sigal Abramovich (2009) state that large complexly formed forams were replaced with smaller simpler forams at the end-Cretaceous extinction.[13] This diminution in size of taxa during extinction periods is attributed to environmental stress and is often referred to as the "lilliput effect." However, this effect is one that is consistent with an increase in surface gravity. Keller/Abramovich note that the largest foram size reductions occur at low to middle latitudes which is the region predicted by the GTME to have had the lowest surface gravitation because it is furthest from the displaced cores and would be most adversely affected by an increase in surface gravity. It is also possible that the smaller foram survivors had a lower density allowing them to remain buoyant in the water column. In a related fashion Steven M. Stanley[16] (2007) points out that at the end-Cretaceous extinction angiosperm species, specifically the broad-leafed evergreens and the low latitude floras of N. America, had the heaviest losses. Again, this would be consistent with an increase in latitude-dependent surface gravity on Pangea.

4.0 SEA LEVEL CHANGE

During the Phanerozoic eon there have been many major worldwide (i.e., eustatic) changes in sea-level. Normal Newell[03] (1967) hypothesized that major falls in sea level were related to marine mass extinction events. The end-Cambrian, end-Ordovician, end-Devonian, end-Permian, end-Triassic and end-Cretaceous periods were all characterized by a major sea-level regression accompanied by mass extinctions, both marine and terrestrial. Most of these major sea-level changes of marine regression was soon followed by transgression These changes are known as regressive/transgressive couplets or supercycles.

Sea level change has been studied extensively especially by Anthony Hallam[04],who has concluded:
1. Eustatic sea level changes, the massive fall and rise of global oceans which are not attributable to the forming and melting of glacial/polar ice are the result of alteration of the volume of oceanic ridges, which can vary based upon their spreading rate and overall length. He supports tectonoeustasy, the tectonic continental splitting and collisions linked with sea-floor spreading as the primary cause of sea-level supercycles.
2. Glacioeustasy resulting from the freezing and melting of polar ice caps might account for very few of the supercycles because most of the Mesozoic was an equable era.
3. Other causes of sea-level change including sedimentation, desiccation of isolated basins and geoidal changes were not likely to have played a major role.

Interestingly, the GTME indirectly supports tectonoeustasy as a cause of sea-level supercycles but in an indirect way. The GTME posits that surface mass, which would include tectonic plates as well as the water involved in polar glacial freezing/thawing, when moving to higher latitudes has caused the displacement of core elements away from Earth-centricity reducing surface gravity on specific parts of the globe. Lowered surface gravity in any region, by definition, results in higher sea level in that region. The supercycles, which are the massive fall and rise of sea level occur, according to the GTME, whenever large surface mass moves rapidly to lower latitudes resulting in higher surface gravity and lower sea level in a region that had lower surface gravity and higher sea level.
For example, when Pangea existed and moved rapidly to higher latitudes as illustrated in Fig. 2 the GTME posits that surface gravity on and near the supercontinent lowered while sea level became higher. The higher seal level is confirmed by the Hallam and Vail sea level charts. Sea level antipodal to Pangea, occupied by the Panthalassa Ocean, was temporally lowered making the term "eustatic sea level" misleading. When Pangea rapidly moved to lower latitudes, surface gravity on Pangea increased and nearby sea level regressed and the opposite happened antipodal to Pangea. When the latitudinal tectonic plate movement ended this was quickly followed, geologically speaking, by a geoidal, equilibrium-balancing flow of ocean water from the antipodal location back toward Pangea completing the supercycle (regressive-transgressive couplet).

5.0 MASSIVE VOLCANIC FLOOD BASALT ERUPTIONS
The temporal relationship between mass extinctions and large eruptions of flood basalt volcanism is well established as illustrated in Fig. 3. Vincent Courtillot[05] (1999) has researched this phenomena and concludes that the correlation of the 12 principal basaltic provinces known as Large Igneous Provinces (LIPs) of the last 300 Ma and the 10 major extinctions is almost perfect. He states that there is less than one chance in a hundred that this could be random.

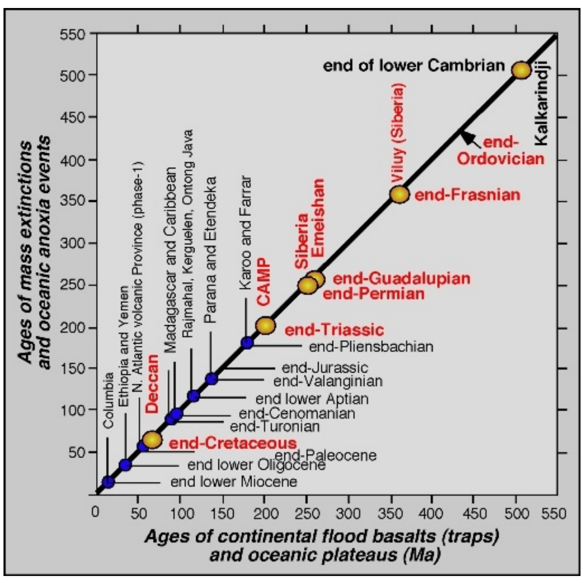

FIG. 3 The temporal relationship between major mass extinctions and flood basalt volcanic traps and plateaus. Courtesy Vincent Courtillot

Flood basalt volcanism initiates at the core/mantle boundary. The correlation between the major eruptions of flood basalt volcanism and core element movement and mass extinctions is posited by the GTME. When the inner core moves within the equatorial plane of the outer core as one or both of them are moving toward Earth-centricity and the outer core's molten fluid flows in a narrower, and therefore faster, region closest to the Earth's spin axis, a hot-spot flow of lava will initiate at the outer core/mantle boundary due to a high thermal transfer to the mantle. The pattern of decreasing magnitude of these basaltic eruptions as the supercontinent Pangea gradually broke apart and its continental remnants dispersed to their current position provides further support for the GTME; the greatest displacement of all three of the core elements occurs when the largest surface mass moves in unison latitudinally, as it would when a supercontinent exists. The massive pressure gradient provided by all three core elements returning toward Earth-centricity may explain why the most intense and largest LIPs occurred when the supercontinent of Pangea existed. Even after Pangea's breakup the continents were still capable of moving partially in unison in the same latitudinal direction.

Flood basalt volcanism is not the primary cause of mass extinctions. It is an after-effect of the core element's movement toward Earth-centricity; increasing surface gravity is the primary cause of the extinctions and the disassociation of methane from the hydrates and its effects are the secondary cause. The magma plume will reach the surface well after the initial associated extinction pulse. The mass extinction interval during the Capitanian extinction (~258-260 Ma) occurred immediately below the first flow of the Emeishan LIP according to Paul Wignall (2015).[10] He further states that the mismatch in timing between the eruptions and mass extinction was also true for the Siberian Traps and the CAMP eruptions. I don't believe this is due to an error in dating the eruptions. The GTME posits that the core element movement initiates the lava plume at the core-mantle boundary which is coeval with the initial extinction pulse and the transit time for the plume to reach the surface is hundreds of thousands to a million years, or more. This accounts for the mismatch in timing. Tony Hallam also agrees that the onset of the eruptions or the interval preceding them is associated with the most damaging environmental effects.[15] He suggests that the rapidity of the eruptions may be correlated with the intensity of the extinctions rather than just the volume of the eruptions. According to the GTME, rapid flood basalt eruptions would be associated with a rapid moving of continental mass to lower latitude and therefore, a rapid increase in surface gravity causing extinction. And, the volume of the eruptions would be related to the volume of continental mass moving in unison to lower latitude. This is why supercontinents, or their recently split apart remnants, are associated with the largest LIPs.

6.0 MASSIVE NEGATIVE CARBON ISOTOPE EXCURSIONS

The massive injection of light carbon into the biosphere has occurred during most mass extinctions and they are often assumed to be the result of volcanogenic activity. The thinking is that the volcanic eruptions emit massive amounts of CO_2 and the rising lava plume may have interacted with beds of coal further enhancing the intensity of the CO_2 emissions. Regarding the PETM, Norman MacLeod (2013)[09] notes that volcanic eruptions that emplaced the Brito-Arctic Volcanic Province was not sufficient to have caused the PETM and the disassociation of methane hydrates, also known as clathrates, could be responsible.

The GTME, as explained previously attributes warm ocean temperature, lower water pressure resulting from lower surface gravity and lower sea level as the conditions which caused methane to be disassociated from methane hydrates at the bottom of the sea. This followed the initial extinction caused by increasing surface gravity and enhanced the extinction interval with global warming and anoxic conditions in both the marine and terrestrial domains.

7.0 GEOMAGNETIC REVERSALS AND SECULAR VARIATION

Geoscientists have been able to confirm the occurrence of geomagnetic reversals during the past 180-200 million years by examining oceanic crust. They have not been able to explain the causation of these reversals but recent literature indicates that they believe plate tectonics might be controlling the frequency of reversals.[07] Their hypothesis is that during intervals when there is an asymmetrical distribution of the continents with respect to the equator intervals of high reversal frequency ensues. They speculate that the distribution and symmetry of mantle structures which drive continental motions at the surface have an influence on equatorial symmetry of the flow within the core destabilizing the dipolar field resulting in a change in the occurrence of reversals.

The GTME also posits that plate tectonics is involved in reversal frequency in a way that is similar to that described previously in this document regarding flood basalt eruptions but different from the hypothesis of the geoscientists mentioned above. According to the GTME, when the displaced core element(s) move toward Earth-centricity, which results from either continental tectonic plates or water (from melting polar ice) moving to a lower latitude, asymmetry of the space between the inner and outer cores develops. This results in a higher flow velocity in one east-west hemisphere of the outer core, as described previously regarding flood basalt volcanism, disturbing the dipolar magnetic field enough to cause a reversal or excursion. Clearly, prior to the displaced core elements moving toward Earth-centricity the Earth's continental center of mass would have moved to higher latitude and therefore surface mass would be asymmetrical with respect to the equator, which is in agreement with one aspect of the geophysicists hypothesis although it's not the assymmetry that initiates the geomagnetic reversal. It is when the movement of the net center of continental mass moves to a lower latitude that a reversal can happen. Again, the continental mass mentioned above is primarily continental tectonic plates or oceanic water that has migrated to the polar regions where it is transformed to ice.

Vincent Courtillot and Peter Olson (2007) suggest a link between superchrons and mass extinctions.[11] They ask whether there is a geophysical connection between traps (i.e., LIPs) and superchrons. They hypothesize that a high temperature thermal perturbation at the core/mantle boundary is what terminates a superchron and results in a return to more frequent geomagnetic reversals. They hypothesize that the lava plume causes the perturbation and the plume ascends to the lithosphere approximately 20 myr later causing the extinctions. They provide several scenarios for the initiation of the superchron.

The GTME posits that the superchrons can only occur when the net center of continental mass remains at the same latitude for an extended period of time. When this happens the inner core remains at equilibrium at the center of the outer core. As explained earlier, when the center of continental mass moves to a lower latitude an asymmetrical positioning of the inner core within the outer core develops. The increased flow velocity at the narrowest region between the inner and outer cores increases the thermal transfer to the mantle in this region. This increased flow velocity has two effects, which are independent: an excessive thermal transfer to the mantle initiates the lava plume and at the same time perturbs the dipolar geomagnetic field increasing the probability of a reversal. However, the transit time of the lava plume to the lithosphere is much less than the 20 myr interval suggested; a transit time of hundreds of thousands to around a million years is posited depending on the velocity of the latitudinal movement of the center of continental mass. Therefore, a plume did not end the superchrons. Although the plume was independent of the geomagnetic disturbance that ended the superchron it was initiated by the same phenomenon: inner core movement relative to the outer core.

The same process involving the latitudinal movement of surface mass occurred during the Pleistocene epoch involving water migrating to polar regions instead of tectonic plates. This explains why, at the end of this epoch, there was a temporal proximity of the start of the current interglacial (~15,000 years BP), when polar ice melted and the melted ice-water moved to lower latitude and the flood basalt eruptions at Campi Flegrei (~ 10,000 years BP). This much shorter plume transit time compared to when supercontinents existed, as stated previously, occurs because the melt-water moved much faster to lower latitudes than the tectonic plates did. There is a temporal relationship between the velocity of surface mass movement to lower latitudes and the resultant lava plume transit time to the lithosphere. The core element movement at the start of the current interglacial period was also responsible for the Gothenburg geomagnetic excursion (~12,350 years BP). This same pattern started about 45,000 to 39,000 years BP involving the Laschamp geomagnetic excursion (~41,000 years BP) followed by a flood basalt volcanic eruption of the Campanian Ignimbrite (~39,000 years BP). The triple effect sequence of ice melt-water moving to lower latitudes (and extinctions) followed by a geomagnetic excursion (or reversal) followed by flood basalt eruption supports the GTME.

Geomagnetic secular variation would be guided by the same phenomena described above for geomagnetic reversals; the oscillations of the inner core within the outer core but the magnitude of the oscillation would be much smaller. This would displace the axis of the magnetic dipole away from Earth-centricity giving it the appearance of drifting around the polar regions. In addition to tectonic plate movement or formation and melting of glaciers/ice caps, possibly ocean currents and earthquakes may influence geomagnetic secular variation.

7.0 BOLIDE IMPACT

The only verified bolide impact associated with a major or mass extinction is the one that formed the Chicxulub crater near the Cretaceous-Tertiary boundary. However, the duration of the extinction crisis particularly that of the negative carbon isotope excursion mitigates against bolide impact as a major extinction factor at the Cretaceous-Tertiary boundary. Locally, a short-duration biotic crisis most likely prevailed from the impact. The airborne debris from the impact would have had to traverse the Panthalassa Ocean, which occupied a vast part of the globe. And, according to the GTME, this region would have been subjected to much higher surface gravity than the antipodal area containing the continents, resulting in rapid draw-down of the debris into the ocean shortening the airborne debris effect on the crisis.

Near the end of the Cretaceous Period a major wobble of the Earth has been detected.[12] At that time the continental remnants of Pangea had begun moving longitudinally toward their current position and the wobble may have been a direct response to this movement as the cores moved toward Earth-centricity. This wobble may have disturbed the near-Earth orbit of the Chicxulub impactor forcing it to eventually collide with the Earth. If this is true then the timing of the impact was not a random occurrence but another phenomena indirectly caused by tectonic plate movement resulting in core element movement.

8.0 CONCLUSION

Many mass extinction theories are based upon the belief that mass extinctions are the result of a convergence of several independent factors, each of which is not capable of producing a mass extinction by itself. This is the Murder on the Orient Express hypothesis. The GTME is based on the premise that there is a single underlying cause of all major mass extinctions and the initial and primary cause is change to surface gravity on part of the Earth's surface. And, that change is the result of substantial offsetting of one or more of the Earth's core elements (inner core, outer core and the densest part of the lower mantle) from Earth-centricity. The offsetting can only occur when large surface mass has moved to a higher latitude, e.g., tectonic plates or ocean water transferred to the polar regions where it is transformed into ice. The Law of Conservation of Angular Momentum governs this offsetting. The return movement of the core elements toward Earth-centricity as a result of the center of mass of the Earth's total surface mass moving to a lower latitude initiates the extinctions. Other phenomena, including negative carbon isotope excursions and flood basalt volcanism along with their byproducts of global warming, anoxia and hypoxia can enhance or extend the duration of the extinctions but they are all side-effects of the offsetting of the core elements. In fact, the disassociation of methane from the hydrates at the bottom of the sea indicated by massive negative carbon isotope excursions is the second most important cause of mass extinctions. The disassociation is a result of the lower surface gravity and massive regression which lower the water pressure on the hydrates combined with the warm ocean temperature.

Once the above concept of core movement is accepted then all the factors temporally associated with mass extinctions are recognized not as random events that happened to occur near the same time but are initiated by the same phenomenon: core element movement. The GTME posits that surface gravity changes, flood basalt volcanism, marine regressive/transgressive couplets (also known as supercycles), massive negative carbon isotope excursions caused by methane hydrate disassociation, megafauna development and extinction, geomagnetic reversals and secular variation are all the result of core element movement.

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