Cause, Origin and Continuation of Plate Tectonics

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Summary

Cause of the Earth's surface manifestations appears to be external to the Earth. Gravitational attraction of the galactic center causes the tides to form in the mantle of the Earth when the solar system reaches the nearest position to the galactic center. Pair of troughs takes shape in the mantle adjacent to the tides as the low and high tides in the ocean. Upwelling tides or megablobs breaks the continental crust and disperses the plates towards the troughs on the surface. In the subsequent cycle, when the solar system again reaches the nearest position to the galactic center, megablobs interchange with the troughs and reassemble the continental crust. In other words, two galactic cycles of the solar system makes one Supercontinent cycle on the surface of the Earth. It appears that the Supercontinent cycle started on the Earth around 2800 million years ago. Nucleation of the inner core was initiated in this period with the beginning of the Plate tectonics. Supercontinent cycle continues as long as the solar system revolves around the galactic center in the presence of liquid outer core in the interior and water on the surface of the Earth.

Introduction

From the time the continental drift was proposed, there were many explanations for the cause of continental movement on the surface of the Earth. But none of them were successfully explained the process and eventually each of those theories left behind some unanswered questions. Even into this period, many people consider the Plate tectonics with skepticism due to the same reason. Undoubtedly there is enormous data in support of this phenomenon. On these grounds the phenomenon itself can't be rejected as imaginary. In this hypothesis, the cause of the Plate tectonics is proposed as the revolution of the solar system around the galactic center. Before dealing with the mechanics of the process, it is necessary to detail some of the characteristics of the phenomenon and existing theories.

What is Plate Tectonics?

In general, Plate tectonics can be defined as the formation of the plates and their movement on the surface of the Earth. In the early part of the Earth history, the trace of Plate tectonics is isolated and not part of a continuous process. Plates continuously dispersed and collided as part of the Supercontinent cycle in the later part of the Earth history. In this period it is difficult perceive the Plate tectonics without the Supercontinent cycle. The period in which the Plate tectonics was associated with the Supercontinent cycle stands apart from the period of irregular movement of the plates. Therefore, if we redefine the Plate tectonics as the continuous and

orderly movement of the plates then the beginning of the first Supercontinental cycle should be regarded as the beginning of Plate tectonics on this Earth.

Fixed Duration of the Supercontinent Cycle

It is interesting to note that the duration of the Supercontinent cycle is always fixed. Even though it is difficult to trace the exact position of the past continental movements, there are other factors which describe this cyclic nature. Collissional mountain ranges, sea level changes, traces of global ice age and other similar deposits explains the formation of Supercontinents after every 425 million years (My) (1). This cyclic nature and the fixed duration of each cycle are important in understanding the Plate tectonics.

Theories of Plate Tectonics

Often the cause of Plate tectonics was described as the subduction of old and dense oceanic plate. According to this theory, breakup of the Supercontinental crust creates new oceanic basins. As the plates move apart, the oceanic plate accompanying the continental plate grows older and the density of the crust increases. After about 200 My, the oceanic plate starts subducting into the mantle and converges the divided continental margins again as a Supercontinent.

This form of crustal movement doesn't generate a regular Supercontinent cycle. At most plates move irregularly on the surface of a planet. As the oceanic plate grows older on both sides of the ridge, subduction should start on both sides of the ridge after 200 My. For the continents to converge, subduction has to begin only at one end of the oceanic plate. Most probably the subduction initiates at the continental margin of the dispersed continent.

Another hypothesis explains the cause as the formation and interchange of megablobs and troughs in the mantle (2). This hypothesis captures the cyclic nature of the Plate tectonics. Temperature anomalies at the core mantle boundary were explained as the cause for the formation of these megablobs. Without the Plate tectonics, temperature in the interior of the planet will be uniform at any specific depth. Under these conditions it is difficult to explain the initiation of megablobs or existence of anomalies at any point of time. This hypothesis doesn't explain how and when the first blobs were formed inside the Earth. A review of this hypothesis (3) also mentioned that the data do not explain the development and evolution of the megablobs.

If we assume the formation of the blobs due to the bombardment of bolides, then there should be a regular interval of the bolide impacts. Mass of the bolide and the place of impact are also important in generating the Supercontinent cycle. Possibilities of the bolide impacts generating the interchanging blobs are very minimal. Continuous formation and survival of the megablobs is possible only when there is a persistent source of heat supply in the interior of the Earth. Megablobs can be compared with the upwelling in boiling water. Any rigorous convection will stop immediately after the heat source was shut off; like the shutting off the burner under the boiling water stops the upwelling of the water. Even if small scale convection remains in the hot water, upwelling can't form without the heat from the burner.

Liquid core should not be considered as a persistent source of heat supply because the total energy in the core is not increasing at any point of time. Liquid core is similar to the hot water in a container with the burner turned off. All the heat in the interior of the Earth is trapped from the molten period of the Earth. Small scale heat generation in the core due to the decay of radioactive elements is not sufficient to initiate the megablobs in the mantle. Therefore, it is not possible to explain the formation of the megablobs in the absence of a persistent heat source in the core.

Galactic Rotation Causes the Plate Tectonics

Earth was in molten state in the early period of its formation and later differentiated into layers. All the objects like the early Earth, without any internal heat generation, cools from the outer layers to inner layers if left undisturbed. As soon as the boiling upwellings disappear on the surface of the molten Earth, surface quickly cools down and forms as an insulated layer similar to the formation of a layer on the surface of the boiled milk when the burner turned off or minimized. After the formation of the insulated layer, heat radiates from the planet at a slower rate. Eventually the insulated layer grows thicker and spreads inward as the heat escapes from the object. At this stage, we can forcefully cool the object faster than it radiates either by continuously peeling off the insulated layer as it forms or by stirring the interior. Shaking the object stirs the interior and breaks the insulated layer. Heat escapes from the interior at the edges of the broken plates until the plates were fused together. In either case it needs external interference in the object to dissipate the heat from its interior faster than it radiates.

All these days the picture of Plate tectonics was described as the upwelling of a liquid in a container on the burner. This picture portrays the mantle as something is continuously heating it from the below. It is obvious that enough heat is not generating in the interior of the Earth to support the convection in the mantle. Therefore the convection in the mantle is similar to the convection in the liquid but the cause of the convection is not the heating from below. In the absence of a persistent heat source in the interior, the cause of mantle dynamics could only be explainable using an external force. So what is this external force that is causing the instabilities in the mantle?

As the solar system revolves around the galactic center, a pair of tides or megablobs forms in the mantle due to the gravitational attraction of the galactic center when the solar system is at nearest position to the galactic center. Troughs take shape in the mantle adjacent to the megablobs. Unlike the tides in the ocean, these tides in the mantle stay at their origin due to the high viscosity of the mantle. Due to the continuous rotation of the Earth, no part of the Earth will be continuously point towards the galactic center. Under these conditions the megablob possibly forms under the Supercontinent due to its compression on the mantle. Upwelling megablob breaks the Supercontinental crust and forms different plates on the surface. Upwelling blob also exert a push on the continental plates and enable them to slide on the oceanic crust. Continental plates gradually drift away from each other towards the troughs in the mantle. As the solar system drifts away from the galactic center, the blobs diminish in intensity. Continents disperse to the maximum extent when they reach the troughs and remain stationary at this position for the remaining period of the galactic cycle. When the solar system again reaches the nearest position to the galactic center, blobs interchange with the troughs in the mantle. These newly formed

blobs push the dispersed continental plates towards the troughs. As the solar system passes through its path, blobs diminish and a Supercontinent forms with the collision of the continental plates. When the solar system again reaches the nearest position to the galactic center, blobs form at the place of earlier troughs and break the Supercontinental crust.

This model explains the cause of instabilities in the mantle as external and cyclic in nature with a fixed duration for each cycle. The tides resulting from the galactic rotation forcefully cools the interior of the Earth by breaking the crust into different plates and moving them on the surface. As the heat escapes from the Earth at the ridges, mantle draws the energy form the core at the core mantle boundary. As a result rigorous convection initiates in the liquid core to replenish the loss of heat at the core mantle boundary. Convection eventually cools the liquid core because there is no other heat generating mechanism exists in the interior of the Earth. Loss of heat in the core causes the crystallization of the core material. Solid material sinks and accumulates at the center of the Earth. Gradual collection of the material at the center of the Earth forms as a solid inner core.

All the heat in the Earth's interior is believed as the trapped heat from its formation. If heat generates in the interior of the planet, core crystallization will not proceed. All the heat escaped at the ridges will get replenished with the heat generating at the center and liquid core never cools down. But this doesn't appear to be happening in the interior of the Earth. At present there is no viable mechanism for generating the heat in the interior of the Earth. Therefore all the circumstances and the data lead to the conclusion that any planet or similar object can't initiate the Plate tectonics on its own. External interference is required to cause the internal disturbance because the planetary body is not a heat generating object. Gravitational attraction of the galactic center on the mantle of the Earth when the solar system is at the nearest position to the galactic center appears to be the plausible explanation for the formation of megablobs in the mantle. Gravitational tides also appear to be forming inside the Earth and the Moon in a smaller scale with the interactions between the Earth, Moon and the Sun. None of the forces in the solar system are sufficient to form the megablobs in the mantle of the Earth extending for millions of years. Therefore, the galactic revolution appears to be the strong possibility for the formation of megablobs in the mantle.

Even though it requires two galactic cycles to complete a Supercontinent cycle, only the end of the second cycle appears to be significant. All the continents converge to form as a Supercontinent at the end of the second galactic cycle. Seafloor spreading drastically reduces with possibly a pause in Plate tectonics and causes a global ice age on the surface of the Earth (1). Tectonic pause possibly fuses all the plates and forms as a single layer covering all the surface of the Earth. Plate tectonics continues as a Supercontinent cycle on the surface of the Earth; not necessarily as a continuous movement of the plates. Upwelling megablobs breaks the Supercontinental crust and creates the new plates. Global warming resulting from the breakup of the Supercontinent melts the ice sheets and floods the continental regions.

At the end of the first cycle, the continents will be dispersed and moving at different directions at different speeds. A pause in Plate tectonics is not possible in this period even though this may also reach a state of minimum seafloor spreading. Tectonic pause, global glaciation, global

flooding and mass extinction marks the end of second galactic cycle as significant compared to the end of first cycle.

Beginning of Plate Tectonics

Even though there is a trace of Plate tectonics as early as 3700 Ma (4), it doesn't appear to be cyclic in nature from this period. This could be the result of crustal movement due to the late heavy bombardment of bolides in that period. Earth witnessed heavy bombardment of bolides between 4000-3800 Ma (5). The trace of Plate tectonics could even be the result of crustal settlement on the surface of the Earth due to differentiation and further cooling of the surface. In any case, we don't see the evidence for the cyclic amalgamation and separation of continental plates between 4500 – 2800 Ma on the surface of the Earth. Most of this early history of the Earth can be described as a static period.

From 2800 Ma, there were a total of six complete Supercontinent cycles with a duration of about 425 My for each cycle (1). If the cyclic nature of the Plate tectonics and the megablobs are correlated, then the blobs could be forming in the Earth only from 2800 Ma. Cratons start moving on the surface as soon as the blobs form in the mantle. It requires at least another 200 My for the first subducted slabs to descend to the core mantle boundary. At the same time, the trace of liquid core also takes about the same amount of period to reach the surface for the first time. In the absence of megablobs, all the volcanic activity might have originated in the upper mantle before 2800Ma. Heat released from the radioactive decay of unstable elements might be the cause of early volcanism.

Geomagnetism: As soon as the slabs descend to the core mantle boundary, rigorous convection initiates in the liquid core due to the heat transfer at the core mantle boundary. Geomagnetism is believed as the result of convection in the liquid core. Because the gap between the subduction and the core mantle boundary interactions is about 200 My, the present intensity in the geomagnetism possibly related to the rate of subduction around 200 Ma. Increase in the geomagnetic intensity around 2700 Ma (6) indicates the beginning of the Supercontinent cycle before this period.

Inner Core Nucleation: Core nucleation initiates and rapidly proceeds when the first slab descends to the core mantle boundary. Massive drawing of the energy from the core initiates the inner core nucleation. The present concept of later development of the inner core (7) around 2500 Ma is also indicates the beginning of the Supercontinent cycle before this period. Before the initiation of inner core nucleation, all the energy released from the radioactive decay distributes uniformly all around the surface and melts the interior of the planet. Megablobs and the internal heat eventually melt the whole planet. Therefore it is not possible for the Earth to have regular crustal movement as long as massive heat is generating in the interior.

An alternative theory proposes that the inner core was developed to the present size in a few hundred million years after the Earth's formation. Initial cooling of the molten Earth was reasoned as the cause for the early nucleation of the inner core. The process of forming an insulated layer doesn't require convection in the interior. As long as heat generates inside the early Earth, cold surface material falls back and convection continues in the whole planet. Once

the heat source was shut off and system reaches the state of equilibrium, cold surface material quickly joins together and forms as an insulated layer. As soon as the layer forms, it obstructs further loss of heat from the object. Subsequently the heat escapes through the insulated layer at a slower rate. At this stage, further loss of heat only occurs when there is a crustal movement on the surface of the Earth. Early initiation of inner core nucleation is not justifiable without the presence of Plate tectonics at that period. Continuous trace of Plate tectonics as well as the core elements on the surface of the Earth from the early period is essential to the notion of early nucleation of the inner core. Oldest known trace element of the core appears to be around 2600 Ma (8). All the data and physical processes only indicate the later development of the inner core. Therefore, the initiation of inner core nucleation can be associated with the beginning of Supercontinent cycle on the Earth around 2800 ma.

The Beginning: Ancient texts described the beginning of the first Supercontinental period around 2800 Ma as the beginning of time (1, 9). Ancient Vedic texts mentioned that the stars started to move in the sky from this period. It was also mentioned that the Earth and the solar system started to revolve around the galactic center from this period. Higher rise in the sea level associated with each Supercontinental breakup period was described as a global deluge on the Earth. The period between two consecutive global deluges was described as a Manvantara with a duration of 308 My. Vedic texts described that the Earth and the solar system revolves around the galactic center within the Manvantara.

Earth witnessed the beginning of Supercontinent cycle, initiation of inner core nucleation, intensity in geomagnetism, emergence of the continental regions possibly due to the melting of the ice sheets and the beginning of terrestrial ecosystems around 2800 Ma. All these episodes mark this period as distinct from the formation of the Earth around 4500 Ma. Because of all these factors, ancient cultures might have treated this period as the beginning on the Earth. The beginning described by the ancient cultures should not be considered as the beginning of the existence of the world; it is only the beginning of the orderly movement of already existing material world.

Alternative Theories to the Plate Tectonics

There were many explanations for the continental movement from the time it was proposed. Even the widely accepted Plate tectonics was itself evolved through different explanations for the phenomenon. Other concepts of the continental movement either accept the Plate tectonics with minor differences or completely oppose the same.

Through out this article it was assumed that the Earth is not generating any heat inside the core; a widely accepted notion in Earth Sciences. However, an alternate view is that a part of the Earth's inner core works as a nuclear reactor generating the heat required for the Plate tectonics (10). An on and off reactor might be able to reverse the geomagnetic poles, but that environment doesn't create the necessities required for the initiation and survival of Plate tectonics. Heat generated by the reactor diffuses uniformly all around the inner core. Gradually the interior of the planet and the outer layers melts with the increasing heat. Eventually the whole planet becomes a molten object. Heat escapes uniformly all around the surface. Under these conditions Plate tectonics will never materialize on a planet. More over the Supercontinent cycle extending for millions of years

is not possible in an environment with much less period for the on/off cycle. This hypothesis also proposes that the geo reactor was working from the formation of the Earth around 4500 Ma, but the trace of Supercontinent cycle is available only from 2800 Ma on the surface of this planet. Most of the available data is consistent with the hypothesis explained in this article, therefore this article continue to assume that the Earth is not generating the heat inside the core.

The theory of expanding Earth completely opposes the concepts of Plate tectonics. According to this theory, continents were separating from each other only from 200 Ma. This theory literally ignores the earlier history of the Earth from its formation. Expansion of the Earth was cited as the cause for the separation of continents. The cause of the expansion ranges from collision to the unknown phenomenon not yet observed. Strong argument of this theory is that even the Plate tectonics wouldn't explain the cause of the continental movement successfully. Uncertainties existed in the earlier theories of the Plate tectonics but contrary to the notion of expanding Earth, data strongly supported the long history of the Earth prior to the beginning of the supposed expansion. The hypothesis of galactic rotation explains the cause of the phenomenon in a simple and comprehensive manner. Vast amount of data and the underlying physical processes are in accordance with this hypothesis. Any other alternative theory has to explain all the available data and the physical processes to gain the support. Expanding Earth or all other alternative theories doesn't appear to fall in this category.

How Long the Plate Tectonics Sustains on the Earth?

It is evident that the Earth completed six complete Supercontinent cycles from 2800 Ma and the present is the seventh cycle. For the survival of Plate tectonics on the Earth, the solar system should continue to revolve around the galactic center. The presence of liquid core in the interior of the Earth is also essential to replenish the loss of heat in the mantle. Water also should be present on the surface to cool and solidify the upwelling material at the oceanic ridges. All these things will probably sustain until the red giant phase of our Sun in another three to four billion years.

Vedic texts described the period of the habitable Earth as fourteen Manvantara cycles. It means the Earth will sustain another seven Supercontinent cycles apart from the current one. It requires another 3 billion years to complete these seven cycles and this period is in conjunction with the modern estimates for the habitable environment to present on the surface of the Earth. Vedic texts also mentioned that fire destroys all the life on the planet at the end of the fourteenth Manvantara cycle and vaporizes all the water on the surface of the Earth. After the loss of life, darkness abounds for a period equal to another fourteen Manvantara cycles. Life emerges and sustains for another fourteen Manvantara cycles after the dark period. According to Vedic texts, this cycle of life and darkness, each with a period of fourteen Manvantara cycles repeated many number of times in the past and continue in the future.

Supercontinents and the Galactic Cycles

All the available data suggests a fixed duration of 425 My for the Supercontinent cycle (1). However, the Rhodinia Supercontinent cycle appears to be spanned from 1500 Ma to 700 Ma, a period of 800 My. If the galactic rotation is the cause of the Plate tectonics, then such a wide

span is not possible for a single Supercontinent cycle. According to this hypothesis, two galactic cycles constitutes one Supercontinent cycle. Current estimate for the galactic cycle is around 200 My (11). The present estimate for these two cycles appears to be compliance with each other. According to this hypothesis, the duration of the Supercontinent cycle would be fixed and it doesn't span longer or shorter than two galactic cycles. The Supercontinent which formed around 1100 Ma might have broken apart in few million years after its formation. Another Supercontinent which broke apart around 700 Ma might have formed in few million years before its breakup.

Even though the Supercontinent cycle and two galactic cycles representing a same geological event, the time taken for these cycles was derived using two different methods. One method is using the directly visible galactic rotation and the other is using the radioactive decay of the unstable elements. According to the present understanding, the progress of time in these two cycles is continuous and independent of each other. One important aspect common in these two cycles is their fixed duration for each cycle. When these two time periods were describing the same geological events, then they should always be the same. It provides a unique opportunity to check the time taken for the astronomical and radioactive processes for the same period between two geological events. It is also important to realize the significance of the galactic cycle in reshaping the surface of the Earth. Sedimentary layers between the two Supercontinental periods can be described as the tidal deposits of two galactic cycles. From this observation, it appears that every major astronomical cycle leaves its mark on the surface of the Earth.

If there is a difference in time between the geologic and astronomical cycles, then one of the underlying processes either the astronomical motion or the radioactive decay could be varying with time. Until the relation is firmly established between the time measured with the astronomical cycles and the time derived from the radioactive decay, it is necessary to mention every ancient point of time with the mode of derivation. If the refined measurements for the galactic rotation yields the period as 100 My for a single cycle, then according to this hypothesis, 200 My of two galactic rotations equals to the 425 My of radioactive decay. In this case, it wouldn't be appropriate to say that the Earth completed two complete cycles around the galactic center from the Triassic-Jurassic boundary at 200 Ma; a period derived from the radioactive decay.

Plate Tectonics on Other Planets

Because all other planets of the solar system were also revolving around the galactic center along with the Earth, galactic cycle would also cause the Plate tectonics on these planets if all the conditions required for the phenomenon were existing at any point of time. Even if it continued for fewer cycles, the duration of the Supercontinent cycle would also be similar to the one on the surface of the Earth.

When the Plate tectonics is of a galactic nature, then the other planetary systems in the galaxy should also posses the phenomenon. The duration for the Supercontinent cycle on the planet depends upon the period for the galactic cycle of the planetary system. If any Earth like planet has the same period for the galactic cycle, then the period for the Supercontinent cycle on that planet would also be similar to the Earth. Ancient Vedic texts mentioned that there are fourteen

worlds in this galaxy. Among them the Earth (Bhur-loka) and the Heaven (Swar-loka) were described as having the same duration for the galactic cycle. It was also mentioned that the Swar-loka also completed the same number of revolutions around the galactic center as our Earth from the first global deluge on the Earth. As the past six Manvantara cycles on the Earth (1), six Indra periods were completed on the Swar-loka and the present is the period of the seventh Indra. As each Manu period begins with a global deluge on the Earth, Indra periods also begin with a global deluge on the Swar-loka. From these descriptions, it appears that the Plate tectonics is present on the surface of the Swar-loka. It was also mentioned that a day and night period on this planet equals to one year on the Earth; a year is 360 years of the Earth.

Before the Beginning

Data suggests that the Supercontinent cycle began on the Earth around 2800 Ma. There is no evidence for the cyclic amalgamation and separation of continents from the formation of the Earth around 4500 Ma to this period. It is widely believed that the planetary system was gradually evolved from its formation to the present. In the present theories, we wouldn't find any proposal for drastic changes in the evolution of the solar system from at least 4000 Ma to the present. But the data suggests that there was a transition period around 2800 Ma between the early static history and the later dynamic history of the Earth. Essential environments required for the initiation and survival of Plate tectonics are the galactic revolution of the Earth, liquid core, mantle, lithosphere, hydrosphere and the continental crust. Plate tectonics initiates on the surface as soon as all of these environments materializes on the Earth. According to the present scientific theories, even the gaseous nebula was also revolving around the galactic center and the same revolution was cited as one of the causes for the collapse of the cloud into the proto-planetary disk. Hydrosphere appears to be present on the surface of the Earth as early as 4400 Ma (12). Formation of the liquid core and the mantle was placed even before the formation of the hydrosphere. Lithosphere, a thick rigid crust on the surface of the Earth, also forms earlier than the hydrosphere. Earliest trace of the continental crust was found around 4000 Ma. Analysis of the Zircon crystals suggests the presence of the continental crust even before this period. All the environments required for the initiation of Plate tectonics appears to exist at least from 4000 Ma. Data suggests the initiation of Supercontinent cycle only around 2800 Ma. Under these circumstances, it appears that any one of the environments might have developed late in the Earth history. If we assume the formation of the lithosphere and the galactic revolution of the solar system as uncertain elements, then there would be three possibilities for the initiation of Plate tectonics.

Continuing galactic revolutions and the later formation of the lithosphere: Earth was in molten state in the early period of its formation. If the early solar system was revolving around the galactic center, then the megablobs were also should be forming in the molten Earth. Megablobs in the completely molten planets would be chaotic in the entire solar system. Megablobs keep churning the planet until the formation of the lithosphere. Churning of the mantle also generates the heat and extends the molten period of the planet. Heat generated by the decay of radioactive elements also extends the molten period of the Earth. Under these conditions, lithosphere probably forms very late in the Earth history. In each galactic cycle, megablobs break the thin crust into small plates and clump them together at the troughs instead of forming the Plate tectonics. Oceanic crust doesn't form under the upwelling megablob.

Cratons continue to move in a Supercontinent cycle all along the history of the Earth. Cratons disperse and reassemble in every two galactic cycles. Mostly hot environment prevails in this period. Upwelling plumes on the surface wouldn't be conducive for the complete formation of the hydrosphere. Patches of hydrosphere might have formed at the troughs in each galactic cycle. Formation of new blobs at the earlier troughs evaporates the hydrosphere and condenses at the new troughs. Lithosphere forms as the mantle cools down and the possibility of inner core formation in this period is very minimal. Plate tectonics would begin at different periods on different planets because the formation of complete rigid crust depends on the size and composition of the planet. To begin the Plate tectonics around 2800 Ma, complete lithosphere shouldn't form earlier to this period. All the available data suggests the early formation of the lithosphere. Moreover it is difficult for the segregation to survive inside the Earth with the massive churning of the entire molten Earth. Therefore megablobs might not have formed in the early molten Earth.

Continuing galactic revolutions and the early formation of the lithosphere: To avoid the churning of the entire molten Earth, lithosphere has to form in less than one galactic cycle, a period of 200 My. If the lithosphere formed within the first galactic cycle of the molten Earth, then the trace of Plate tectonics should also be present continuously from that period because all other environments required for the initiation of Plate tectonics were existing as early as 4400 Ma. Solid inner core should also be forming with the initiation of Plate tectonics. If the early Earth was generating the heat with the decay of radioactive elements then the molten period of the Earth also gets extended. Lithosphere forms only when heat is not generating inside the Earth. If the Plate tectonics starts after the formation of the lithosphere, then the inner core nucleation also begins in the interior of the Earth. All the available data suggest the later development of the Plate tectonics and the inner core. Therefore, the data and the physical processes associated with the early Earth are inconsistent with the notion of galactic revolution of the early molten Earth.

Early formation of the lithosphere and later initiation of the galactic revolutions: All the available data suggests the early cooling of the molten Earth. Lithosphere, hydrosphere and the continental crust formed as early as 4400 Ma. Earth remained cold for most of the early history. Intermittent bombardment of bolides and volcanism thawed the environment but there weren't any major crustal movements in this period. Beginning of the movement of the solar system around the galactic center could have initiated the Plate tectonics on the surface of the Earth around 2800 Ma. Galactic revolution of the Earth is a characteristic of the entire solar system; therefore, if the beginning of the galactic revolution was the cause of the initiation of Plate tectonics then the Plate tectonics would begin at the same time on all the planetary bodies of the solar system. Even though all the data is constant with this notion, the concept of early stable solar system is not conceivable with the present theories of the planetary sciences.

Every molten object generates the blobs in its revolution around the galactic center including the Sun. Blobs continue to resurface on every planetary body and paves the surface until the formation of the lithosphere. In the Subsequent galactic cycle, Plate tectonics initiates if the blobs are sufficient to break the lithosphere. If the blobs are not sufficient to break the lithosphere, then the surface remains undisturbed from that period. Later the surface simply responds to the internal tides as long as there is a mantle. As mentioned earlier, if the solar

system was revolving around the galactic center from the beginning then the Plate tectonics would begin at different periods on different planetary bodies. If the beginning of the galactic revolution of the solar system initiated the Plate tectonics, then the Plate tectonics would begin at the same period on all the objects. Sun would appear brighter with the beginning of the galactic revolution due to the initiation of megablobs.

Conclusion

The cause of the Plate tectonics appears to be external to the Earth because there is no viable mechanism for generating heat inside the Earth to cause perturbations in the mantle. Revolution of the solar system around the galactic center appears to be the cause of perturbations in the mantle. Orderly movement of the tectonic plates in a Supercontinent cycle is the result of two galactic cycles of the solar system. Core nucleation is the result of the tidal perturbations in the mantle. It was widely believed that the latent heat released from the crystallization of the inner core fuels the convection in the mantle. The sequence of events according to this notion are cooling liquid core, formation of the solid inner core, release of latent heat, convection in the mantle and its surface manifestations. A well shielded liquid core doesn't release the heat at the rate to cause the perturbations in the whole mantle. More over a continuous release of heat can't form megablobs in the mantle. Heat generated by the decay of radioactive elements also can't form the blobs in the mantle. Therefore, heat from the radioactive decay or the latent heat released from the nucleation of the inner core can't initiate or sustain the Plate tectonics on the surface of the Earth. Only the galactic revolution of the Earth appears to be causing the megablobs to form in the mantle. Loss of heat in the liquid core maintains the viscousity of the mantle. According to the hypothesis described in this article, the sequence of events would be galactic rotation, perturbations in the mantle, plate movements, subduction of the oceanic crust, loss of heat in the liquid core and nucleation of the inner core.

Even though Earth formed around 4500 Ma, megablobs appear to be forming in the mantle only from 2800 Ma. Beginning of the galactic revolution of the solar system or the formation of lithosphere around this period might have initiated the Supercontinent cycle. Inner core nucleation initiated with the beginning of Plate tectonics. If the blobs evolved later in the Earth history, Earth might have expanded to some extent when the first blobs were formed in the interior. Without the internal dynamics, Earth’s surface looks more like a static environment. Crust start to move on the surface as soon as the blobs form in the mantle. If the megablobs diminish in size and no longer sufficient to break the crust, the planet probably shrinks and upper crust folds to accommodate the changes in the planet.

Ancient description of other planetary systems forming at the same time as our solar system is an indication to a cluster of systems acting collectively. Further exploration into the planetary formation and its early dynamics promises better understanding of the beginning of the Plate tectonics on the Earth. Formation and the evolution of the galaxy as well might influence the development of Plate tectonics.

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Note: This article is a copy of my Geocities page initially posted at *http://www.geocities.com/karunakarm/causeofpt.html* on August 18th, 2002. The theory presented in this article was discussed extensively in the news groups. This article is presently available at *http:/kmarasakatla.org/earth/causeofpt.html* . All other links referring to the geocities site are also available at *http://kmarasakatla.org*.