

Creation of Global Supercontinents by Force of the Rotating Earth's Changing Axis

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Abstract: In the course of the creation of the earth, continents formed that united, became supercontinents, and in continuation split into small continents which again united, again creating supercontinents. This cycle of phenomena probably was ongoing in the course of the earth's entire existence.

The main force causing the above phenomena, the movement of the continents and especially the direction they move in, as well as the upper part of the magma in the mantle, is the centrifugal force of the rotational movement of the earth following the change in location of the axis of the earth's rotation relative to the mantle of the earth and, in accordance, a change in the location of the equator.

Key Word: Supercontinents; centrifugal force; earth's rotation; location of equator; Convection current; plate tectonics

I. INTRODUCTION

There are mechanisms that balance and stabilize the earth so that it can continue to be relatively stable over for a long time. Some of these mechanisms were presented in a number of studies by Y. Greitzer (Jun., 2020; 10 Sep., 2020; 22 Sep., 2020; 22 Oct., 2020; Jun., 2021).

The force that creates the supercontinents and the subjects connected to it is the central subject of the present article and is actually also a continuation of the five articles noted above.

I propose here that the power moving the continents and creating the supercontinents is caused by a number of forces, but mainly by the rotation of the earth and the change in its axis on the mantle, and accordingly the location of the equator (Figs. 1, 2).

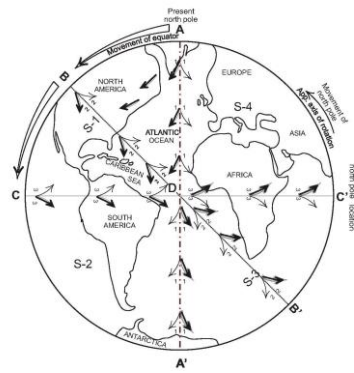


Figure 1. Movement of equator 90^0 from point A to C (movement of pole also 90^0 from point C' to A). View from Atlantic Ocean – Caribbean Sea. By Y. Greitzer

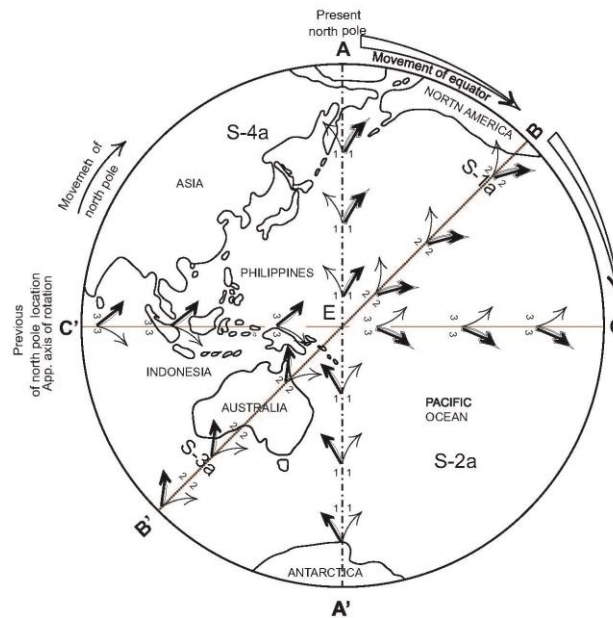


Figure 2. Movement of equator 90^0 from point A to C (movement of pole also 90^0 from point C' to A). View from Pacific Ocean, Philippines – Caribbean Sea. By Y. Greitzer

II. THE CENTRIFUGAL FORCE BEHIND THE MOVEMENT OF CONTINENTS AND CREATION OF SUPERCONTINENTS - CHANGE IN THE AXIS OF THE ROTATING EARTH

The movement of continents was first discerned by Wegener (1922, 1966), who in his studies established the basis for the theory of plate tectonics. Since then, there are many theories explaining the forces causing the movement of continents based mainly on internal processes in the earth.

Proposed and explained by Greitzer (June 2020), as noted above, is that the main force is the centrifugal force of the earth's rotation following the change in location of its the axis of the rotation relative to the mantle of the earth and, in accordance, a change in the location of the equator (Figs. 1, 2).

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The assumption is that over an extended geological period, the axis of the earth's rotation in a pseudo-circular orbit changes its location. In the model presented (Figs. 1, 2), explanations are given for the possibility of a change in the axis of the earth's rotation in a peripheral manner by about 900 and, in accordance, about a 900 change in the equator's location. The actual movement of the continents depends also on many other geological factors.

The assumption was that the location of the axis of the earth's rotation in circles of large circumferences changes its position on the globe significantly relative to the mantle of the earth. The speed of rotation of the mantle crust - Lithosphere of the earth is highest at the equator and gradually decreases towards the north and south poles. Hence the change in location of the equator will cause a significant change in the forces of movement – speed of the rotation – centrifugal force, that act on the continents and will move them. The movements of the continents will be, in accordance, related to the intensity and directions of the new centrifugal forces.

Since the creation of Earth and its beginning rotations, I assume that in the course of the geological eras there was a trend and direction change in location of the axis of rotation (Figs.1, 2, 3, 4). The possibility of this change and, in accordance, of the change in the location of the equator that relates to the last geological era, approximately the Mesozoic to Recent (around 200 - 250 m.y.) was reconstructed and presented in Greitzer (June 2020, and Figs.1, 2 of the present study). Likewise, the assumption is that in earlier periods, the earth's rotational axis changed its location by a scope of several rotations on the globe (Figs 3, 4). This was not necessarily done in circles of full circumference, but assumedly in large circles, as noted above. An explanation is proposed for the activity of the centrifugal forces acting on the continents whereby the axis of the earth's rotation and the equator changed their locations on the earth by about 900 (Figs. 1, 2).

The movement of every continent is actually determined according to its location relative to the equator, to the speed of its previous movement, to the size of its mass and to its lithologic composition, and also relative to some parts of other neighboring continents. The size of a continent's mass affects the degree of its acceleration. The degree to which a continent is split depends mainly on its position relative to the equator and to the relations between the speed of the continent's movement and the speed of the movement of the change in location of the equator. In the course of its movement the continent meets other continents moving at slower speeds or in different directions and at the point of contact a tectonic fold may be created such as the Alpine; or subduction of the frontal part of one continent, slab pull, or ridge push, or other tectonic forms may be created in accordance with the pressure created between the two colliding continents.

III. 3. SUPERCONTINENTS CREATED IN THE COURSE OF EARTH'S DEVELOPMENT

Known and accepted by the science community is that in the course of the earth's development there were a number of supercontinents that split into smaller continents and parts of continents. In the continuation of earth's development, they, or most of them, reunited and again created supercontinents. This phenomenon was discovered by experts in different fields, including geologists, geophysicists, paleontologists, geographers, climatologists and others through their many independent and cooperative research.

There is certain uniformity and agreement on the number of supercontinents that formed in the course of the earth's development, but there are differences between the different researches on the size of the supercontinents that were formed, on their shape and also on their creation in relation to the different ages (Tables 1, 2).

Clearly, the older the created supercontinents were the harder to determine their actual existence, their size and how long ago they were created. This is because the longer the time passed since they existed, the greater the changes produced in them, and thus it is harder to discover and to reconstruct the changes

There are different theories regarding the forces that caused the supercontinents to separate, to come together again, and to again create a supercontinent. It should be noted that evidently there existed a combined activity of several of the forces that create the supercontinents, that are mentioned in the literature: Bradley D. C. (2011), Cadie, K. C., Candie (2011); Coltice Nicolas Laurent Husson, Claudio Faccenna (2019); Cramer, F., Lithgow-Bertelloni, C. (2017); Damian R, Nance and J. Brendan Murphy, (July 2013); Evans, D.A.D. Evans (2003); Kobe, Randy (2011); Stern, Robert J., Bloomer, S. H. (2020); Nance, R.D.; Murphy, J.B.; Santosh, M. (2014); Riguzzi, F.; Panza, G.; Verga, P.; Doglioni, C. (2009); Summeren, J., Conrad, C. P., Lithgow-Bertelloni, C. (2012); Zhong S. Zhang N., Li Zi Z-X and Roberts J. N. (2007).

However, the main force causing the movement of the continents and mainly the direction of their movement, in my opinion, are the centrifugal forces of the globe, and due to the changing location of the earth's rotation axis (changing the TPW), a change accordingly in the location of the equator (Greitzer Jun.,2020).

This force is the force that caused the supercontinents' unification and their division in the course of the creation of the earth (Figs. 1-4),

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The ancient supercontinents were smaller and with the passing of time they expanded following the rise of lava from within the earth's mantle which enlarged the continents. Likewise, following the settlement of sediments in the oceans between parts of the continents and after tectonic activities, the sediments that sank in the oceans rose and created a chain of mountains that joined parts of the continents and thus with time enlarged them.

To explain the current work, in relation to the forces operating in creating the supercontinents and in their division and the rejoining of some of them anew to create supercontinents, two estimations of their ages are presented, Table 1 from Wikipedia, and Table 2 from Wikipedia by Bradley (2011).

Table 1.

- Vaalbara (~3.6 billion years ago)
- Ur (~3.1 billion years ago)
- Kenorland (~2.6 billion years ago)
- Columbia, also called Nuna (~1.8 to 1.5 billion years ago)
- Rodinia (~1.1 billion years to ~750 million years ago)
- Pannotia, also called Vendian (~600 million years to ~540 million years ago)
- Oldredia (~418~380 million years ago)
- Euramerica (~300 million years ago)
- Pangaea (~300 to ~200 million years ago)
- Laurasia (~510 to ~200 million years ago)

Table 2. Supercontinents throughout geologic history

The following table names reconstructed ancient supercontinents, using Bradley's 2011 looser definition, with an approximate timescale of millions of years ago (Ma).

Supercontinent name	Age (Ma)	Period/Era Range	Comment
<u>Vaalbara</u>	3,636–2,803	Eoarchean-Mesoarchean	<u>Also described as a supercraton or just a continent[8]</u>
<u>Ur</u>	2,803–2,408	Mesoarchean-Siderian	Described as both a continent ^[2] and a supercontinent ^[9]
<u>Kenorland</u>	2,720–2,114	Neoarchean-Rhyacian	Alternatively the continents may have formed into two groupings Superbia and Scavia
<u>Arctica</u>	2,114–1,995	Rhyacian-Orosirian	<u>Not generally regarded as a supercontinent, depending on definition[2]</u>
<u>Atlantica</u>	1,991–1,124	Orosirian-Stenian	Not generally regarded as a supercontinent, depending on definition
<u>Columbia (Nuna)</u>	1,820–1,350	Orosirian-Ectasian	
<u>Rodinia</u>	1,130–750	Stenian-Tonian	
<u>Pannotia</u>	633–573	Ediacaran	
<u>Gondwana</u>	550–175	Ediacaran-Jurassic	From the Carboniferous, formed part of Pangaea, not always regarded as a supercontinent
<u>Pangaea</u>	336–175	Carboniferous-Jurassic	

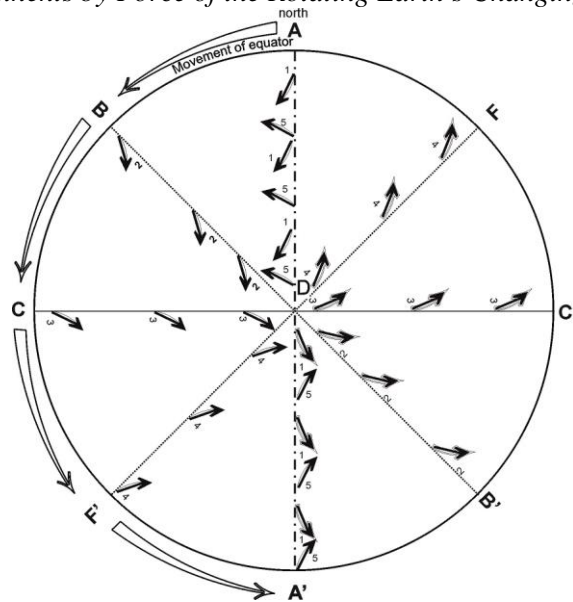


Figure 3. Equator moved 180° from point A to B, C, F', A' (movement of pole also 180° from point C' to F, A, B, C). View from point D, the Atlantic Ocean – Caribbean Sea. Continents moved in the direction of the Arrows By Y. Greitzer

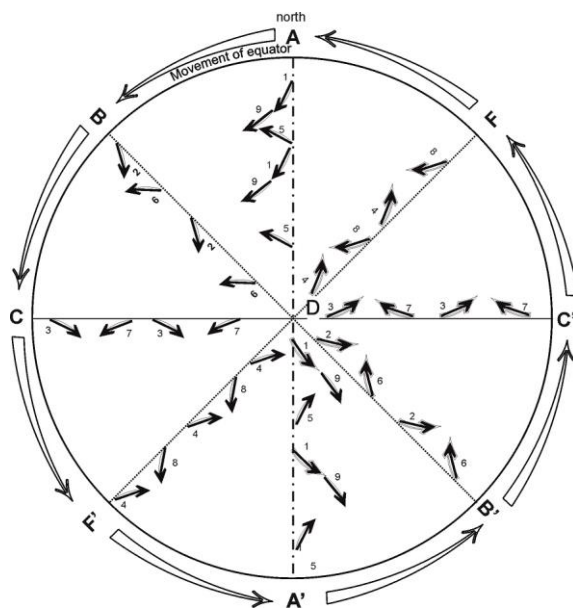


Figure 4. Equator moved 360° from point A to B, C, F', A', B', C', F, A (movement of pole also 360° from point C' to F, A, B, C, F', A', B', C'). View from point D, the Atlantic Ocean – Caribbean Sea. Continents moved in the direction of the Arrows By Y. Greitzer

IV.DISCUSSION

The direction of the changes and movement of the continents from the Mesozoic period to the present day is about 200- 250 million years and is presented as an abstract in the present study in chapter 2 and in Figures 1, 2.

Presented are four figures that represent the direction of the movement of the continents following the change in location of the earth's axis. Three- 1, 3 and 4, represent their movement from a view of the Atlantic Ocean on the Caribbean Sea area – the Bermuda Triangle, point D. This point represents one of the ends of "the region of axis of rotation that changes the location of the equator" (Fig.1). The other end of this region, is in the opposite side of the earth, in the Philippines – Dragon Triangle, point E (Fig. 2) (Greitzer, Sep. 22).

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Figure 1 represents a change of the equator on the mantle of 90 degrees. Figure 3 represents the change of 180 degrees of the equator on the mantle, and Figure 4 represents the change in the equator on the mantle of 360 degrees. The continents move in the direction indicated by the arrows in accord with the direction of the change of the equator: change of location of the equator by 90 degrees (Fig.1), in which the movement of the continents are represented by arrow nos. 1, 2, 3; in continuation of the change of the equator's location to 180 degrees (Fig. 3), the movements of the continents are represented by arrow nos. 3, 4. One already sees that towards the end of the continents' move of 180 degrees, in accord with arrows no. 5, the continents move in an opposite direction of the initial move of the continents, arrows no.1.

In continuation of the move of the equator's location to 360 degrees, arrow nos. 6,7,8, all represent the continents that move in the direction opposite to that of arrow nos. 2,3,4,5. whereas arrow no. 9 is in the direction of arrow no. 1, which starts the cycle from the beginning.

The inference from this is that in the course of their movement the continents split, as presented in Figure 1. And in splitting, they enlarged and expanded from magma rising from the mantle and material from volcanic eruptions and also from layers of sediment that sunk into the oceans and rose up through tectonic activities. Afterwards the continents could move in different directions, including movement in opposite directions, and in different periods join and produce supercontinents or parts of supercontinents.

Pangea, according to Wegener (1922, 1966) and the literature, existed in the Mesozoic about 200-250 million years ago, split and created the current continents of the earth (Greitzer, June 2020).

As estimated, in the ongoing process of the creation of the earth and of the first continent, the rotating earth's axis changes. In order to estimate the number of its rotations made since the creation of the first continent, it is estimated that in about 250 million years the equator changed on the mantle by 90- degrees (Greitzer, June 2020), Assuming that the rotation of the earth moves at a speed equal in time to that at its inception (the speed at the beginning of its creation was faster thus, if we think according to different estimations in the literature that the first supercontinent Vaalbara existed 3.6 billion years ago (Tables 1,2), the axis of the rotating earth can be estimated that the rotation of its axis and in accord the change in location of the equator, within the realm of four rotations in large circumferences they changed their location on the earth's mantle. It should be noted that the rotations were not in complete circumferences though in large ones since point D must represent an area of a certain size of the earth's rotational axis. It is estimated the location of this area today and since 250 million years ago, on one side of the earth, is the Bermuda Triangle, point D, and on the opposite side of the earth, is the area of the Dragon Triangle, point E (Greitzer, Sep. 2020). Likewise, it should be noted that the areas represented by point D (Fig. 1) and point E (Fig. 2) also moved in the course of years since the creation of the earth.

The estimation obtained according to Greitzer's (June 2020) calculation is that in a span of about 250 years the change in location of 90 degrees on the mantle of the rotational axis of the earth is in accord with the change of the equator, (Figs. 1,2). This change caused the division of the Pangea supercontinent into a number of continents, which are still continuing to split. Figures 3 and 4 were prepared according to this model and, according to the estimation, represent the split and the reunification of the continent by the change on the mantle of the axis of the rotating earth by 180 degrees (Fig. 2) and by 360 degrees (Fig. 4). the arrows in these figures represent the direction of the continents' moves whereby the direction of the moves is in accord of the progressive movement of the equator.

Evident from Figure 3 is that when the equator reaches the rotation of 180 degrees, the direction of the continents' movement is reversed, to the beginning of the breakup of the continents' movements, which is represented by arrows no. 1. And that is manifested by arrows no 5, which are in an opposite direction to arrows no. 1. Whereas it is estimated that every ~90 degrees rotation of the equator lasts about 250 million years, thus in a rotation of 180 degrees, that is 500 million years, there is a possibility of uniting the continents into a supercontinent or a large continent that could be called a sub-supercontinent.

Evident from Figure 4 is that when the equator moves in a 360-degree direction, the direction of the continents' movement continues to be contrary to that of their breakup and reunification (arrows 6,7,8 contrary to arrows 2,3,4. And when the rotation reaches ~360 degrees, the breakup cycle begins anew (arrows no. 9 that are in the same direction as arrows no. 1).

The estimated time it takes to change the location of the equator by 360 degrees is about 1 billion years. Whereas the age of the earth is estimated to be ~4.5 billion years, it can be estimated that the axis of the rotating earth and accordingly the equator on the mantle changed by ~4 rotations. It should be emphasized that the rotations were not complete but in only in large circumferences (Greitzer Sep. 2020).

It can be estimated that the supercontinents were formed in cycles of about 500 million years (assumedly between 400 and 600 million years) and in the combined cycles of all of them ~ 1 billion years (assumedly between 0.8 to 1.1 billion years) and it was possible to create semi-continents in the intermediate stages, because the continents in the intermediate periods could move in opposite directions thus having the capabilities to unite. Everything said is a general estimation - is in order of magnitude.

An attempt was made to compare the above estimations with the following time estimations for the creation of the main supercontinent (Table 1, 2).

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A certain match was found respecting the times the continents were created according to my calculations presented above when comparing to those appearing in Tables 1 and 2, especially in regard to the earliest supercontinents, as follows (Tables 1, 2):

According to Table no' 1

Vaalbara 3.6 billion years ago – Ur 3.1 billion years ago = **0.5 billion years ago**

Ur 3.1 billion years ago – Kenorland 2.6 billion years ago = **0.5 billion years ago**

Kenorland 2.6 billion years ago - Columbia, also called Nuna 1.8 – 1.5 billion years ago = **1.1 billion years ago**

Columbia, also called Nuna 1.8 – 1.5 billion – Rodina 1.1 billion years ago to 750 million years ago = **0.75 billion years ago**

According to Table no' 2

Vaalbara 3.636 billion years ago, Eoarchean – 2.803 billion years ago, Mesoarchean = **833 million years ago**

Ur 2.803 billion years ago, Mesoarchean – 2.408 billion years ago, Siderian = **395 million years ago**

Kenorland 2.720 billion years ago, Mesoarchean – 2.114 billion years ago, Rhyacian = **606 million years ago**

Aretica 2.114 billion years ago, Rhyacian – 1.995 billion years ago, Orosirian = **119 million years ago**

Atlantica 1.991 billion years ago, Orosirian – 1.124 billion years ago, Stenian = **867 million years ago**

Columbia (Nuna) 1.820 billion years ago, Orosirian – 1.350 billion years ago, Ectasian = 470 million years ago

Rodinia 1.130 billion years ago, Stennian – 750 million years ago, Tonian = **380 million years ago**

Pannotia – Ediscaran 633 – 573 million years ago = **60 million**

Gondwana 550 million years ago, Ediacaran – 175 million = **375 million ago. Formed part of Pangaea.**

V. CONCLUSION

In the course of the earth's development there were a number of super-continents that split into smaller continents and parts of continents, after which they again united forming a supercontinent.

There are various theories regarding the forces that caused the supercontinents to separate and to reunite. It should be noted that there is evidently a combination of forces causing the movement of continents and also forming supercontinents noted in the literature, of which one of the most important accepted by scientists is convection current. However,

in my opinion, the main force which moves the continents and creates supercontinents, and especially the direction of the continents' movement, is the centrifugal force of the rotational movement of the earth following the change in location of the axis of the earth's rotation relative to the mantle of the earth and, in accordance, a change in the location of the equator.

This force is the force that caused the unification of the continents and their breakup in the course of the creation of the earth, mainly relying on the assumption that the axis of the earth in accordance with the equator changes in a circular form on the mantle (Figs. 1,2,3,4). As a result of this, the continents move in a specific direction, and afterwards move in an opposite direction.

The time estimated for a change in location of the equator in a semi-circle of 360 degrees on the mantle (Fig. 4) is 1 billion years. Since the age of the earth is estimated as ~4.5 billion years, one can estimate that the axis of the rotating earth, and in accord the equator, changed on the mantle by about 4 rotations. It should be noted that the rotations were not in complete circles but in large circles.

It is possible to estimate that the supercontinents were created in cycles of ~500 million years (assuming between 400 and 600 million) and the large supercontinents in cycles of ~1 billion years (assuming between 0.8 and 1.1 billion), as likewise semi-supercontinents could be created in the intermediate stages since the continents in the intermediate periods, also moving in opposite direction, so that they could unite. Everything said is a general estimation - is in order of magnitude.

In keeping with the above estimations, an attempt was made to compare the estimated ages of the continents published in the literature, in the course of the creation of the earth and relating to Tables 1 and 2. A certain match was found between my estimations presented above and those of the supercontinents, mainly regarding the earlier ones..

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