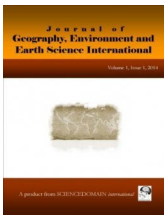

Journal of Geography, Environment and Earth Science International
7(1): 1-7, 2016; Article no.JGEESI.26454
ISSN: 2454-7352

SCIENCEDOMAIN *international*
www.sciencedomain.org

Fictitious Supercontinent Cycles

J. Marvin Herndon[1*]

[1]*Transdyne Corporation, 11044 Red Rock Drive, San Diego, CA 92131, USA.*

Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/JGEESI/2016/26454
Editor(s):
(1) Masum A Patwary, Geography and Environmental Science, Begum Rokeya University, Bangladesh.
(2) Fombe Lawrence Fon, Regional Planning and Development, Faculty of Social and Management Sciences, University of Buea, Cameroon.
(3) Iovine Giulio, CNR-IRPI (National Research Council-Institute of Research for the Geo-hydrologic Protection) of Cosenza, Italy.
Reviewers:
(1) Andrei Nechayev, Lomonosov Moscow State University, Russia.
(2) Anonymous, Universidade Federal de Santa Catarina – UFSC, Trindade, Florian´opolis, SC, Brazil.
(3) Anonymous, Italy.
(4) Vladimir M. Anokhin, Herzen State University, Russia.
Complete Peer review History: http://www.sciencedomain.org/review-history/15521

Short Communication

Received 19th April 2016
Accepted 16th July 2016
Published 26th July 2016

ABSTRACT

In the physical sciences, attempts to describe processes, events, and phenomena upon the basis of problematic paradigms can be wholly incorrect and lead to physically impossible consequences, *e.g.*, the ultraviolet catastrophe of radiation physics, and/or can necessitate *ad hoc* assumptions and can be unreasonably complex, *e.g.*, the epicycles of planetary physics. Like epicycles, I suggest that supercontinent cycles, sometimes referred to as Wilson cycles, are artificial constructs, attempts to describe geological observations upon the basis of problematic paradigms. Here I describe the foundation for that assertion and offer insight into a fundamentally different geoscience paradigm, Whole-Earth Decompression Dynamics, which obviates the need to assume supercontinent cycles.

Keywords: Mantle convection; whole-Earth decompression dynamics; fold-mountain formation; Wilson cycles.

**Corresponding author: E-mail: mherndon@san.rr.com;*

1. INTRODUCTION

Phenomena, processes, or events, when described in terms of a problematic paradigm, yield explanations that are generally more complex, if not logically unrelated or physically impossible, than corresponding explanations posed later within a different, better understood, and more-correct paradigm. For example, in the Ptolemaic Earth-centered universe paradigm, the observed apparent motion of planets, specifically their retrograde motions, were described by complex epicycles (Fig. 1). Within the state of knowledge at the time, that explanation seemed to explain the observed retrograde planetary motions, but we now know that epicycles are artificial constructs and that Earth is not located at the center of the Universe. The lesson to be learned is this: If complex *ad hoc* explanations are necessary to make some observations seem to fit within current knowledge, then consider that as an invitation to question current knowledge. Similarly, in the classical, pre-quantum physics paradigm, an ideal black body in a state of thermal equilibrium was calculated to emit radiation with essentially infinite power in the shorter wavelengths: This is the so-called ultraviolet catastrophe, a circumstance that is physically impossible. Later, in the now-known, more-correct quantum physics paradigms, black body radiation, and other phenomena, can be explained logically, causally, and with greater simplicity, without invoking complex, *ad hoc* assumptions.

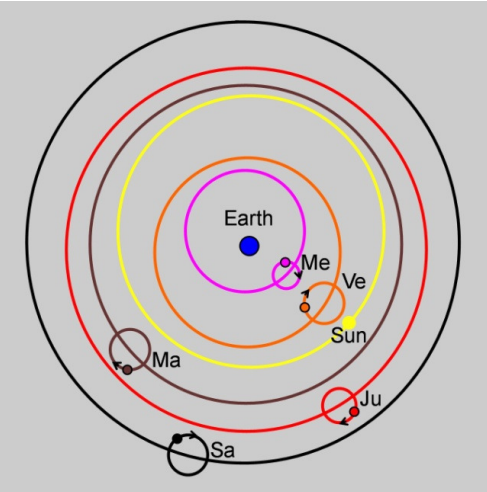

Fig. 1. Epicycles were able to explain apparent retrograde motion of planets in the problematic Earth-centered Ptolemaic universe paradigm

2. DISCUSSION

The progress of science involves replacing less precise understanding with more precise understanding. To make advances in scientific understanding, one needs to find out the failings of the extant paradigm [1]. In other words, in popular speech, ask the question: “What is wrong with this picture”?

Consider seafloor spreading. ● In the old expanding Earth theory [2], ocean floor is thought to form as continents move apart during Earth expansion. But, the problem is that seafloors are no older than about 200 million years, but geological evidence, such as continuity of geological features such as coal beds, suggests that continents separated long before that. So, Earth expansion theory as originally formulated cannot be correct, which is not surprising as Earth expansion theory lacks energy sources of sufficient magnitude. There must be another more correct paradigm. ● Plate tectonics seems to explain ocean floor topography and seafloor magnetic striations by basalt being extruded at mid-ocean ridges, moving across the seafloor, and disappearing into trenches [3]. But to explain the 200 million year maximum seafloor age, the further assumption of mantle convection is necessary. But mantle convection is physically impossible, as described in the scientific literature [4] and below, so plate tectonics, like Earth expansion theory cannot be correct. Hence, there must be a more correct paradigm that explains ocean floor topography at least as well as plate tectonics but without necessitating physically-impossible mantle convection. And indeed there is. ● Whole-Earth Decompression Dynamics [5] is one of the consequences of Earth’s early formation as a Jupiter-like gaseous planet wherein the rocky part was compressed to about 66% of present diameter. After being stripped of its massive gas envelope, eventually the rocky Earth began to decompress. New surface area has to form to accommodate the increased diameter and it does so by the formation of surface cracks, cracks underlain by heat sources capable of extruding molten basalt and cracks lacking heat sources into which extruded basalt infills. Extruded basalt flows by gravitational creep until it encounters a crack and falls into, thus filling it. Oceanic troughs are partially in-filled decompression cracks. This process explains ocean floor topography without necessitating mantle convection and without posing a limit on temporal separation of continents. Another surface consequence

described by Whole-Earth Decompression Dynamics is that of the formation of mountains characterized by folding. Such mountains necessarily result from changes in surface curvature to accommodate changes in planetary diameter. Understanding the latter concept is crucial to understanding why supercontinent cycles are artificial constructs.

Geological literature contains a plethora of papers, for example [6-8], dealing with various aspects of so-called 'supercontinent cycles', also called 'Wilson cycles'. This is the idea that before Pangaea, there were a series of supercontinents that each formed and then broke apart and separated before colliding again, re-aggregating, and suturing into a new supercontinent in a continuing sequence. Here, I suggest that 'supercontinent cycles' are artificial constructs, like epicycles, attempts to describe geological phenomena within the framework of problematic paradigms. Then the question to ask is what current ideas necessitate *ad hoc* supercontinent cycles in order to make some observations seem to fit within current knowledge; these are the concepts one should question. Ask the question: Why supercontinent cycles?

One of the fundamental questions in geology is the origin of mountains characterized by folding [9]. The *ad hoc* explanation offered by plate tectonics is that such mountains formed from a land mass that was lengthened by collision with another land mass. So, by that reasoning Pangaea's fold-mountains that predate the break-up of Pangaea must have formed during some previous supercontinent break-up and re-assembly. These are the "epicycles" of plate tectonics, artificial constructs. Now we can question what is wrong with plate tectonics that necessitate such *ad hoc* explanations.

In the broad picture there are two main concepts for planetary formation generally. One idea involves condensation from primordial matter at very high pressures, 10^2 to 10^3 atm., where 1 atm. equals the present pressure of our atmosphere at Earth's surface. The other idea, widely popular since the 1960's supposes that condensation from primordial matter occurred at very low pressures, ca. 10^{-4} atm. [10,11]. The latter, referred to as the 'planetesimal hypothesis', was 'accepted' by the planetary science community as the 'standard model of solar system formation'. Earth formation is frequently described by that model which is based upon the assumption that dust, condensed from primordial matter at those low pressures, accumulated into progressively larger grains, rocks, and eventually planetesimals that finally accumulated to make planets [12,13]. This, however, as I discovered is a flawed paradigm [14-17] as it contradicts observations. This is why.

As known from their high relative bulk densities, the inner planets, *i.e.*, the terrestrial planets, all have massive cores. The thermodynamic calculations I made show that the condensate of primordial matter at low pressures, such as 10^{-4} atm., would be oxidized, like the minerals of the Orgueil C1/CI carbonaceous chondrite meteorite. Virtually all of the Orgueil minerals are combined with oxygen; there is no iron metal. Condensation from primordial matter at pressures of about 10^{-4} atm. occurs at low temperatures in which the environment is oxidizing. There would be essentially no iron metal condensed to form the massive-cores of the inner planets. This is a contradiction to observations [15,18].

The 'standard model of solar system formation' is therefore problematic, being unable to account for massive-core planets, but it requires additional *ad hoc* hypotheses as well. One additional *ad hoc* hypothesis, that of a radial solar-system temperature gradient during planetary formation, is necessary to explain the loss of primordial gases of the inner planets, which is necessitated by the further assumption that planetary formation took place after the thermonuclear ignition of the Sun. That radial temperature gradient *ad hoc* hypothesis assumes the existence of a warm inner region delineated by a hypothetical 'frost line' located between Mars and Jupiter. Beyond the 'frost line' ice/gas condensation is assumed possible to explain the giant gaseous planets. Yet another necessary *ad hoc* hypothesis is that of a 'magma ocean', *i.e.*, whole planet melting, to explain core formation from essentially uniform undifferentiated chondritic matter.

Beginning in the 1960s, the plate tectonics hypothesis was developed and 'accepted' by many as the paradigm to explain Earth dynamics. The topography and magnetic striations of the seafloor are explained well by basalt being extruded at mid-oceanic ridges, moving across the ocean expanse, and disappearing into trenches. Plate tectonics, in a manner consistent with the planetesimal hypothesis, explains the mechanism and fate of

"subducted" ocean floor basalt slabs as being part of mantle convection cells that act as great conveyer belts recycling ocean floor basalt into the mantle.

In 1931, Holmes [19] introduced the concept of mantle convection (Fig. 2) as a motive force for Wegener's continental drift [20]. In Holmes' mantle convection idea, the rocky part of Earth is assumed to circulate in great loops, like endless conveyer belts, dragging the continents along. The assumption of mantle convection is a critical component of plate tectonics, not only for seafloor spreading [21], but also for continental movement [22,23]. Continent masses are assumed to ride atop assumed convection cells, much as Holmes envisioned for continental drift. In plate tectonics, plate collisions are thought to be the principal mechanism for fold-mountain formation. Indeed, the occurrence of mountain chains characterized by folding that significantly predate the breakup of Pangaea is the primary basis for assuming the existence of supercontinent cycles with their respective periods of ancient mountain-forming plate collisions.

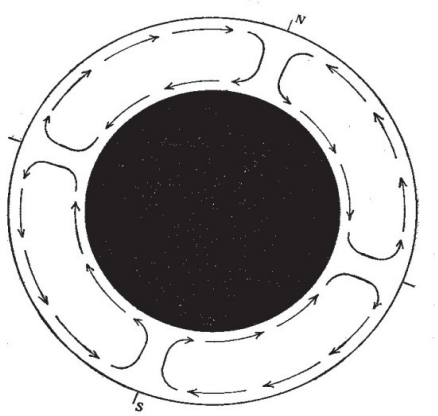

Fig. 2. Representation of mantle convection published by Arthur Holmes in 1931 [19]. Reproduced with the permission of the Geological Society of Glasgow

The assumption of mantle convection critically underlies virtually all aspects of plate tectonics including supercontinent cycles. Numerous computational models have been made supposedly demonstrating mantle convection. Generally, models are constructed with a known end result and various assumptions or data selection included to achieve that known-ahead-of-time end result [1]. However, as I disclosed [4,24], there is a serious problem.

Convection is a familiar process. Observe water in a pan atop the kitchen stove. Before the water begins to boil, circulation occurs which is more readily observed by adding a few mustard seeds or tea leaves. Water at the bottom becomes warmer, and therefore less dense. This is a gravitationally unstable configuration – heavier on top, lighter on the bottom – which corrects the instability by fluid motions [25]. A less obvious observation is that the water at the bottom of the pan is insignificantly compressed by the weight of water above. In striking contrast, Earth's mantle is 62% denser at the bottom than at the top, caused by compression by the weight above [26], as illustrated in Fig. 3. Thermal expansion at the bottom can only decrease the density by about 1% or less. This small decrease in density cannot overcome the much higher density at the mantle's bottom, about 62%. Sometimes model-makers attempt to obviate the 'bottom heavy' situation, caused by the weight above, by assuming that the mantle behaves 'adiabatically', *i.e.*, like an ideal gas with no viscous losses. The mantle, however, is a crystalline solid, not an ideal gas, and it that does not behave as an ideal gas. Why? An ideal gas does not support stress, and the earthquakes that occur at depths as great as 660 km by their very occurrence indicate the catastrophic release of stress. Thus, mantle convection is physically impossible. Sometimes, people calculate a high Rayleigh Number and use that to justify mantle convection, however, the calculation in not justified as the Rayleigh Number was derived for a non-compressed thin film [27].

In the absence of mantle convection, plate tectonics has no valid scientific basis. Of course, that is not the only problem with plate tectonics. Only about 41% of Earth's surface is continental rock (sial); the balance is ocean floor basalt (sima). Neither plate tectonics nor the so-called standard model of solar system formation can account in a logical causal manner for Earth's two component surface crust. Moreover, without mantle convection there is no motive force for driving continental displacement or supercontinent cycles. The reasonable conclusion one must draw is, as in the case of epicycles, there must exist a new and fundamentally different geoscience/planetary-science paradigm that is better capable of explaining observed geological features.

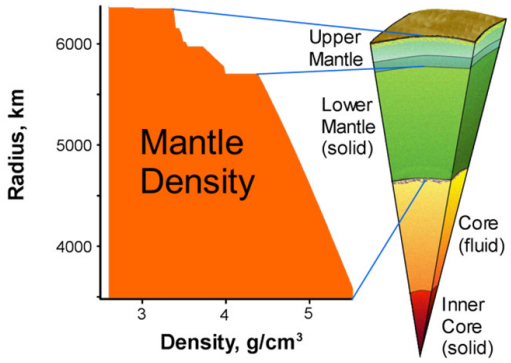

Fig. 3. Density as a function of radius in the Earth's mantle [26]

I have described in published works the details and implications of a new indivisible geoscience paradigm: Whole-Earth Decompression Dynamics [4,5,15,28-33]. The geology and geophysics of Earth is the consequence of our planet's early formation as a Jupiter-like gas giant that occurred before the thermonuclear ignition of the Sun. Whole-Earth Decompression Dynamics accounts for: (1) The myriad observations, including seafloor topography, attributed to plate tectonics but without requiring physically-impossible mantle convection via decompression-driven geodynamics; (2) A mechanism for fold-mountain formation resulting from decompression-driven changes in surface curvature that does not necessarily require plate collision; (3) The internal composition and highly-reduced oxidation state of Earth; (4) Formation of the Earth's core without whole-planet melting; (5) Newly-conceived and powerful internal energy sources, protoplanetary energy of compression and georeactor nuclear fission energy; (6) Newly-conceived mechanism for heat emplacement at the base of the crust, the basis of the geothermal gradient, and; (7) Georeactor geomagnetic field generation. This new geoscience paradigm, especially (2) above obviates the necessity to assume supercontinent cycles.

Briefly, as first suggested by Eucken [34], Earth's core rained-out by condensing from solar matter at a high-pressures and high-temperatures, followed by the more-volatile silicates. Complete condensation, I submit, led to Earth's early formation as a Jupiter-like gas giant. The weight of 300 Earth-masses of gas bearing down on the rocky kernel of Earth compressed the rocky portion to about 66% of its present diameter, sufficient compression for a solid continental-rock layer to cover the entire rocky part of the planet. After removal of the gases by solar T-Tauri eruptions, presumably during the thermonuclear ignition of the Sun, the enormous gravitational energy of compression, stored during the Jupiter-like phase, became available to power later decompression and its resulting geodynamic activity; what remained was a solid Earth, smaller than at present, whose rocky surface consisted entirely of continental rock (sial), without ocean basins. Eventually, internal pressure became sufficiently great to begin to crack the closed contiguous shell of continental rock that originally formed. In honor of Ott Christoph Hilgenberg, who first conceived of its existence [35], I call that 100% closed primary surface layer *Ottland*.

The geology of planet Earth, according to Whole-Earth Decompression Dynamics, is primarily the consequence of just two processes: (1) Decompression-increased planetary volume progressively, although intermittently, forms cracks at the surface to increase requisite surface area, and; (2) Decompression-increased planetary volume causes requisite adjustment of surface curvature.

Regarding (1) above, as the Earth decompresses and increases in diameter, driven by the stored energy of protoplanetary compression, augmented by georeactor nuclear fission energy, it must form new surface area to accommodate its greater diameter. It does so by forming surface cracks. Surface decompression cracks are of two types: *primary* with underlying heat sources, and *secondary* that lack heat sources. Basalt extruded from primary cracks migrates and eventually falls into and in-fills secondary cracks, a process that develops ocean basins and yields understanding of seafloor magnetic striations and topography even better than plate tectonics and without requiring physically-impossible mantle convection.

Regarding (2) above, as illustrated by the demonstration in Fig. 4, curvature changes of the continental rock surface are necessitated by decompression-increased planetary volume. Whole-Earth decompression makes necessary a change in surface curvature. As illustrated in the center image of Fig. 4, any continental surface area that is undergoing whole-Earth decompression finds itself with "extra" surface area confined within its perimeter. This is a gravitationally unstable configuration that rights itself, as I have disclosed [30]. This adjustment in change of curvature can be accommodated by buckling, breaking, and falling over upon itself.

Formed in this manner, mountain ranges characterized by folding contain their 'extra' surface area within present continental boundaries and do not necessarily require or imply continent collision. Thus the primary basis for assuming supercontinent cycles is therefore obviated.

Fig. 4. The formation of fold-mountains as a consequence of Earth's early formation, as a Jupiter-like gas giant, results by the adjustments to surface curvature that must take place during decompression [21]

Left image: Two balls represent the relative proportions of 'present' Earth (pink) after decompression, and 'ancient' Earth (blue) before decompression. Center image: Spherical section, representing a continent, cut from 'ancient' Earth and placed atop the 'present' Earth. This shows that the curvature of the 'ancient continent' does not match the curvature of the 'present' Earth and further shows that the 'ancient continent' has confined within its fixed perimeter 'extra' surface area. Right image: Tucks remove 'extra' surface area thus illustrating the process of fold-mountain formation that is necessary for the 'ancient' continent curvature to conform to the 'present' Earth curvature. Rock, unlike the ball-material, is brittle so at some point tucks in the Earth's crust would break and fall over upon themselves producing characteristic folding

Models of supercontinents engaged in hypothetical Wilson cycles typically make use of problematic paleomagnetic calculations. As I have shown [36], whole-Earth decompression can lead to significant errors in magnetic paleo-latitude calculations. Moreover, paleo-pole calculations, used to imply continent rotations, are without meaning due to changes in Earth-radius. The combination of no means of supercontinent locomotion, fold-mountain formation without the necessity of collisions, significant errors in magnetic paleo-latitude calculations, and the invalidity of magnetic paleo-pole calculations all together call into question the entire concept of supercontinent cycles. Fictitious supercontinent names, such as Rodinia, Columbia, and even Pangaea, will eventually pass into history along with planetary epicycles. The challenge for geologists will be to discover the true sequence of fragmentation beginning with Ottland and continuing to the present and to discover the nature of Earth's surface throughout that progression.

3. CONCLUSION

Supercontinent cycles, like planetary epicycles, are artificial constructs, attempts to describe phenomena within the framework of a problematic plate tectonics paradigm. Whole-Earth Decompression Dynamics obviates the need for supercontinent cycles.

DEDICATION

This work is dedicated to the memory of Lynn Margulis (1938-2011) who repeatedly urged and insisted that it should be written.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Herndon JM. Some reflections on science and discovery. Curr. Sci. 2015;108:1967-1968.
2. Carey SW. The expanding earth. Elsevier: Amsterdam. 1976;488.
3. Vine FJ, Matthews DH. Magnetic anomalies over oceanic ridges. Nature. 1963;199:947-949.
4. Herndon JM. Geodynamic basis of heat transport in the earth. Curr. Sci. 2011;101: 1440-1450.
5. Herndon JM. Whole-earth decompression dynamics. Curr. Sci. 2005;89:1937-1941.
6. Condie KC. Breakup of a paleoproterozoic supercontinent. Gond. Res. 2002;5:41-43.
7. Phillips BR, Bunge HP. Supercontinent cycles disrupted by strong mantle plumes. Geol. 2007;35:847-850.
8. Ryan PD, Dewey JF. Continental eclogites and the wilson cycle. J. Geol. Soc. Lond. 1997;154:437-442.
9. Suess E. Das antlitz der erde. F. Tempky: Prague and Vienna; 1885.
10. Grossman L. Condensation in the primitive solar nebula. Geochim. Cosmochim. Acta 1972;36:597-619.
11. Larimer JW. Chemistry of the solar nebula. Space Sci. Rev. 1973;15:103-119.
12. Goldrich P, Ward WR. The formation of planetesimals. Astrophys J. 1973;183: 1051-1061.

13. Wetherill GW. Formation of the terrestrial planets. Ann. Rev. Astron. Astrophys. 1980;18:77-113.
14. Herndon JM. Reevaporation of condensed matter during the formation of the solar system. Proc. R. Soc. Lond. 1978;A363: 283-288.
15. Herndon JM. Solar system processes underlying planetary formation, geodynamics, and the georeactor. Earth, Moon, and Planets. 2006;99:53-99.
16. Herndon JM. Nature of planetary matter and magnetic field generation in the solar system. Curr. Sci. 2009;96:1033-1039.
17. Herndon JM. New indivisible planetary science paradigm. Curr. Sci. 2013;105: 450-460.
18. Herndon JM. Inseparability of science history and discovery. Hist. Geo Space Sci. 2010;1:25-41.
19. Holmes A. Radioactivity and earth movements. Trans. Geol. Soc. Glasgow 1928-1929, 1931;18:559-606.
20. Wegener AL. Die entstehung der kontinente. Geol. Rundschau. 1912;3:276-292.
21. Hess HH. In Petrologic studies: A volume in honor of a. F. Buddington, Geological Society of America: Boulder. 1962;599.
22. Bunge HP, Hagelberg CR, Travis BJ. Mantle circulation models with variational data assimilation: Inferring past mantle flow and structure from plate motion histories and seismic tomography. Geophys. J. Int. 2003;152:280-301.
23. Davies GF. Whole-mantle convection and plate tectonics. Geophys. J. R. Astron. Soc. 1977;49:459-486.
24. Herndon JM. Uniqueness of herndon's georeactor: Energy source and production mechanism for earth's magnetic field. arXiv.org/abs/0901.4509; 2009.
25. Chandrasekhar S. The onset of convection by thermal instability in spherical shells. Phil. Mag. 1953;44:233-241.
26. Dziewonski AM, Anderson DA. Preliminary reference earth model. Phys. Earth Planet. Inter. 1981;25:297-356.
27. Rayleigh L. On convection currents in a horizontal layer of fluid, when the higher temperature is on the under side. Phil. Mag. 1916;32:529-546.
28. Herndon JM. Energy for geodynamics: Mantle decompression thermal tsunami. Curr. Sci. 2006;90:1605-1606.
29. Herndon JM. Maverick's earth and universe. Trafford Publishing: Vancouver; 2008.
    ISBN: 978-971-4251-4132-4255.
30. Herndon JM. Origin of mountains and primary initiation of submarine canyons: The consequences of earth's early formation as a jupiter-like gas giant. Curr. Sci. 2012;102:1370-1372.
31. Herndon JM. A new basis of geoscience: Whole-earth decompression dynamics. New Concepts in Global Tectonics. 2013; 1:81-95.
32. Herndon JM. Terracentric nuclear fission georeactor: Background, basis, feasibility, structure, evidence and geophysical implications. Curr. Sci. 2014;106:528-541.
33. Herndon JM. Herndon's earth and the dark side of science. Printed by CreareSpace; Available at Amazon.com and through Other Book Sellers; 2014.
34. Eucken A. Physikalisch-chemische betrachtungen ueber die frueheste entwicklungsgeschichte der erde. Nachr. Akad. Wiss. Goettingen, Math.-Kl. 1944; 1-25.
35. Hilgenberg OC. Vom wachsenden erdball. Giessmann and Bartsch.: Berlin. 1933;56.
36. Herndon JM. Potentially significant source of error in magnetic paleolatitude determinations. Curr. Sci. 2011;101:277-278.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/15521