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Geophysical Circumstances Enabling Giant Dragonfly Flight in the Carboniferous and Permian Periods

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ABSTRACT

For more than a century there has been controversy as to the circumstances during the Carboniferous and Permian periods which made flight possible for giant dragonflies. Higher air density and elevated oxygen levels have been suggested, however, increased metabolic rates would lead to heat-exchange problems. Recently, Alan E. R. Cannell concluded from engineering investigations that higher air density, in the range 1.5-1.6 bar, would aid in thermal regulation, which would as well enhance flight aerodynamics. Contrary to plate tectonics, my new indivisible geoscience paradigm, *Whole-Earth Decompression Dynamics*, leads in a logical, causally-related manner to higher air density during the time giant dragonflies flourished. Even within the limitations of these simple calculations, the results suggest that during the Carboniferous and Permian periods only about half of the surface area comprising deep-ocean basins had opened.

INTRODUCTION

Paleontologists have provided humanity with a plethora of records of life in the geological past. Regrettably, however, their interpretations of environments and circumstances related to their discoveries are all too often tainted by incorrect descriptions based upon plate tectonics. Plate tectonics theory is underpinned by false assumptions, including for example mantle convection [1], supercontinent or Wilson cycles [2], infallibility of paleolatitude determinations [3], and by unspecified energy sources.

Before flying reptiles and birds, the skies of the Carboniferous and Permian periods were dominated by giant dragonflies. *Meganeura monyi* lived approximately 300 million years ago and had a wingspan of up to 70 cm [4] (Figure 1). *Meganeuropsis permiana* lived about 290-283 million years ago with a wingspan estimated to have been up to 75 cm [5].

For more than a century there has been controversy as to the extant circumstances which made flight possible for these giant insects. Typically reference is made to higher oxygen levels, however, increased metabolic rates would lead to heat-exchange problems. As far back as 1911, Harlé and Harlé [8] suggested that wing-powered flight required higher air density. The suggestion was later repeated [9], that higher air density would facilitate flight. In 2018, Alan E.R. Cannell [10] published a Commentary entitled, *The Engineering of the Giant Dragonflies of the Permian: Revised Body Mass, Power, Air Supply, Thermoregulation and the Role of Air Density*. Cannell concluded that higher air density, in the range 1.5-1.6 bar, would aid in thermal regulation which would as well enhance flight aerodynamics.

Figure 1: Fossil *Meganeura monyi* collected in France, Brongniart (1884). Source [6]. For more information, see [7].

The purpose of this article is to disclose, contrary to plate tectonics, that my new indivisible geoscience paradigm, *Whole-Earth Decompression Dynamics*, leads in a logical causally-related manner to higher air densities during the time giant dragonflies flourished.

BRIEF BACKGROUND

I have described a fundamentally new, indivisible paradigm that recognizes Earth's early formation as a Jupiter-like gas giant and makes it possible to derive virtually all of the geological observations and geodynamic behavior of our planet, including two previously unanticipated powerful energy sources whose absence otherwise raises insuperable dilemmas. Earth's interior condensed from primordial matter at high-pressures, high-temperatures, with Earth's fluid iron alloy core first raining-out at the planet's center [11-21].

Primordial condensation at high-pressures, high-temperatures progressed on the basis of relative volatility with the first condensate being molten iron and elements dissolved therein. The primordial gas at high-pressures, high-temperatures led to an oxygen-starved fluid iron alloy core, including portions of Earth's oxygen-loving elements such as uranium, silicon, calcium, and magnesium. Uranium precipitated and settled at the center of Earth where it eventually began functioning as a nuclear fission reactor [11-13, 15, 17-21], producing the geomagnetic field [16, 17, 19, 21-24]. Silicon precipitated as nickel silicide and formed Earth's inner core [25]. Calcium and magnesium precipitated as sulfides and floated to the top of the core, forming the seismically "rough" matter observed there [11, 26].

As Earth's fluid core formed, other oxyphile or oxygen-loving elements exsolved from the fluid condensate as the solid silicate, enstatite ($MgSiO_3$) which formed Earth's lower mantle. Rocky-matter condensation followed along with in-falling debris forming Earth's upper mantle and crust. Primordial condensation continued with the most volatile substances condensing as ices and gases to form a fully condensed gas giant proto-Earth having a mass almost identical to Jupiter [27].

Subsequently, violent T-Tauri phase solar winds, accompanying thermonuclear ignition of the sun, stripped the ices and gases away leaving, at the beginning of the Hadean eon, a rocky planet, fully covered by continental rock, compressed to about two-thirds of present-day Earth-diameter, and containing within itself the great stored energy of protoplanetary compression [28-31].

As described by *Whole-Earth Decompression Dynamics*, Earth's subsequent decompression accounts for virtually all of Earth's surface geology and geodynamics [1, 28, 29, 32-34].

As whole-Earth decompression progresses and as Earth's volume increases, its surface area increases by the formation of decompression cracks [28]. Primary decompression cracks with underlying heat sources extrude basalt-rock, which flows by gravitational creep until it falls into and infills secondary decompression cracks that lack heat sources. This accounts for the separation of the continents and for the topography of Earth's ocean basins.

As whole-Earth decompression progresses and as Earth's volume increases, its surface curvature must change. The manner by which surface curvature adjusts to changes in volume explains, in logical, causally-related ways, the formation of mountain chains characterized by folding as well as fjords and submarine canyons [35, 36], Figure 2.

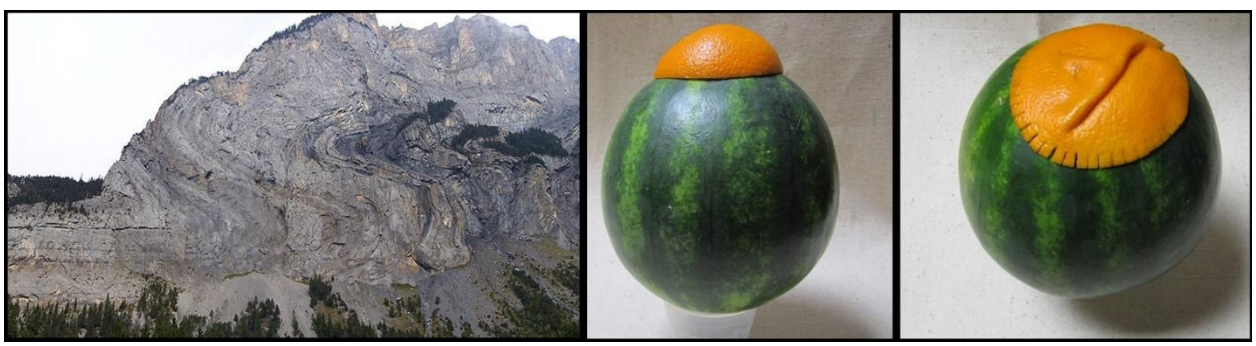

Figure 2: Left: Example of mountain folding; Center: The necessity for surface curvature change during whole-Earth decompression. The un-decompressed Earth is represented by the orange, while the larger, decompressed Earth, is represented by the melon. Note the curvatures do not match; Right: Two causally-related curvature-change mechanisms that naturally result in surface curvature change, namely, major curvature adjustment by folded-over tucks, minor curvature adjustment by continental-perimeter tears.

Whole-Earth Decompression Dynamics explains, more completely and more correctly, observations usually attributed to plate tectonics without requiring physically-impossible mantle convection [1] or fictitious super-continent cycles [2]. In addition, *Whole-Earth Decompression Dynamics* explains geological observations that are inexplicable by plate tectonics, including the geothermal gradient [32], oceanic troughs, the origin of petroleum and natural gas deposits [37], and more.

FACILITATION OF GIANT DRAGONFLY FLIGHT

Immediately after the primordial ices and gases were stripped from the juvenile Earth, there were no ocean basins and no mountains. Continental crust entirely covered the globe. If we knew the surface area of that contiguous continental crust, Earth's juvenile radius could be easily calculated. The present continental surface area plus continental shelves, 2.104 X 10^8 km^2 [38], however, is an underestimate of the juvenile crustal surface area, but it provides a "first guess" estimate for calculating an estimate of the juvenile Earth radius, 4092 km, using the equation for the surface area of a sphere. The gravitational acceleration at Earth's surface related to Earth radius is $g(r) = GM/r^2$

As both G and M cancel, the ratio of gravitational acceleration at Earth's surface as a function of radius relative to present gravitational acceleration, g_a/g_p, is $g_a/g_p = g(r)/g(present) = (6371)^2/r(t)^2$

As air density is a function of gravitational acceleration, the ratio g_a/g_p expresses atmosphere density increase at Earth's surface that results from whole-Earth decompression relative to present Earth radius.

The upper curve in Figure 3 shows g_a/g_p as a function of Earth radius. Ideally, that ratio should be expressed as a function of time. Data do not yet allow this. Instead the lower portion of Figure 3 shows the opening of ocean basins, without continental shelves, that result from whole-Earth decompression.

Ocean Basin Fraction of Planetary Surface Area = $[4\pi r^2$ - crustal surface area$]/4\pi(6371)^2$ where crustal surface area is 2.104 x 10^8 km^2 [38].

In Figure 3, the droplines facilitate reading the range of Earth radii and ocean basin fraction that are related to the atmosphere density range deduced by Cannell [10] for giant dragon flies.

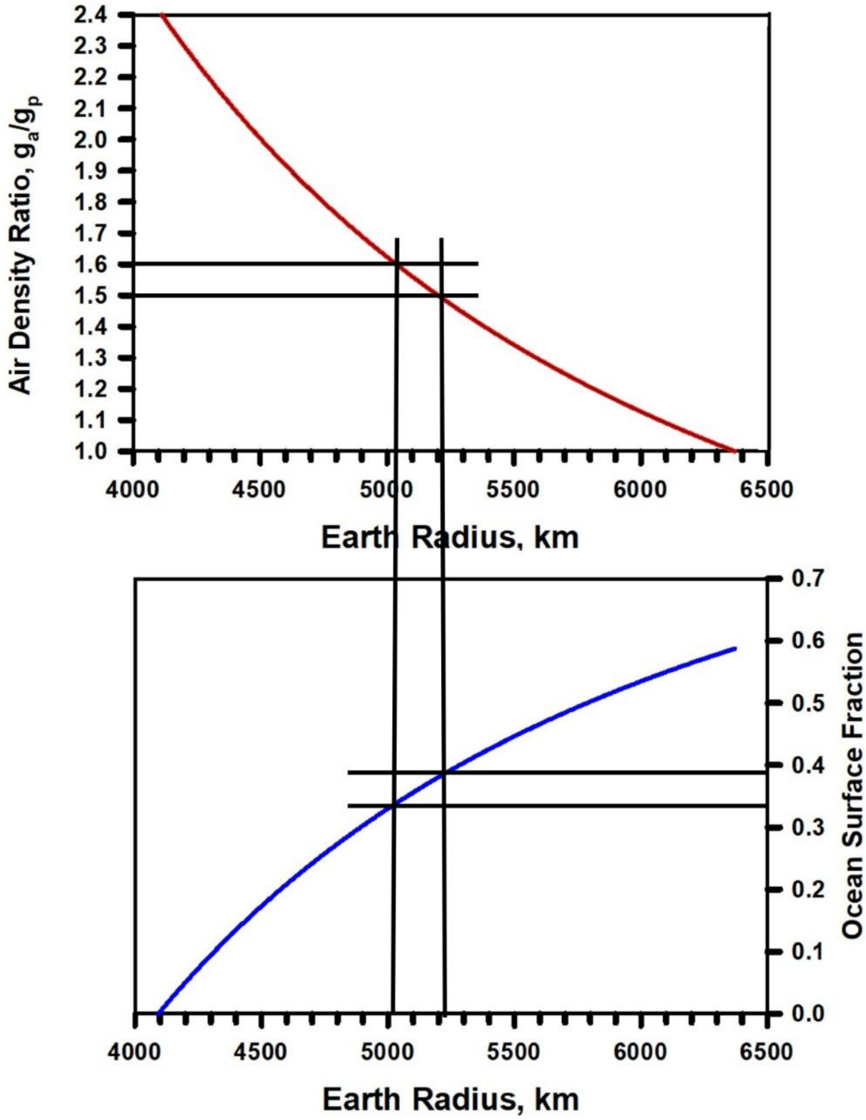

Figure 3: Upper: Increase in atmosphere density increase, g_a/g_p, at Earth's surface that results from whole-Earth decompression relative to present Earth radius. Lower: The opening of ocean basins, without continental shelves, that result from whole-Earth decompression. Drop lines facilitate connecting the three relationships even in the absence of temporal data.

CONCLUSIONS

The relationships shown in Figure 3 are based upon simple calculations that do not consider the change in continental surface area that results from surface curvature adjustments that take place via fold-mountain formation [33, 36]. Nevertheless, increased atmospheric density during the Carboniferous and Permian periods is an expected consequence of *Whole-Earth Decompression Dynamics* and may be consistent with the increased density level of 1.5-1.6 bar deduced by Cannell [10] to aid in thermal regulation, which would as well enhance flight aerodynamics. This example represents the first attempt to connect paleontological data with the consequences of *Whole-Earth Decompression Dynamics*. Even within the limitations of these simple calculations, the results suggest that during the Carboniferous and Permian periods only about half of the surface area comprising deep-ocean basins had opened.

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