

# *PLANETS, SATELLITES and LANDFORMS*



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# *Planets Satellites and Landforms*

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“Whoever undertakes to set himself up as a judge of Truth and Knowledge is shipwrecked by the laughter of the gods”

Albert Einstein



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## INTRODUCTION

Continental drift theory is a major acknowledgment of the last century. However; the theory fails to say why all the continents started moving from one position on Earth's surface, or why they formed there in the first place.

A primary aim of this treatise is to suggest mechanisms that initiate Proto Continent formation before continental drift, and to draw universal conclusions from those mechanisms.

A secondary aim is to suggest mechanisms that might explain several unanswered, or partially answered earth science and astronomy questions including:<sup>1</sup>

- ☐ The thermal history of Earth is inadequately addressed in commonly available earth science texts. Most books on the subject postulate the Earth was hot and then cooled. Existing theories fail to explain where the seas/volatiles were initially, and whether the Earth started hot, or became hot later.
- ☐ Several scientists believe the Moon came from the Earth. However; most mechanisms (where stated) for the Earth/Moon separation employ the most unique/improbable collision sequences. Such theories are not convincing, because they do not explain the origin and orbits of other planets' satellites. This treatise attempts to present a universal mechanism showing a possible origin for all the satellites, and the asteroid belts.
- ☐ There is no all embracing theory to explain the ring structures surrounding Saturn and other planets. This treatise ties that phenomenon into a progression of planetary evolution, associated with a genesis theory for meteorites and diamond pipes (Kinetic Pipes).
- ☐ Three major components of Earth's rotation are considered, and provide alternate mechanisms to those presented elsewhere.
- ☐ We briefly explore micro and macro weather effects in association with tectonic activity.

This treatise premises:

- A. That all planets started from similar genetic dust material.
- B. That variations observed in the Solar System planets arise from differences in size, location, and evolution, rather than any underlying differences in origin, or proto material.
- C. Observations of planet bodies can help decipher the Earth's sequence of development. Similarly, interpretation of geological events on Earth can help to explain planetary phenomenon.

In building from this base, observations compare existing heavenly bodies with events that occurred on Earth, or future events. The following summary discusses sun/planet genesis citing Earth examples where appropriate. The summary is then tabulated into a universal set of "Dynamic Development Stages" that draw conclusions about the current state of development at other planets and satellites.

I am naturally very interested to receive any comment on the contents.

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<sup>1</sup> John Waldman. *Geology Mule Simple*, Rev. Ed, Made Simple Books. Doubleday & Coy Inc, New York, 1982, p135

1  
*SUMMARY SEQUENCE OF SOLAR SYSTEM EVENTS*

## 1.1 BASIC CONSIDERATIONS OF SOLAR SYSTEM INITIATION

- 1 This treatise proposes that subsequent to a super nova explosion, there was a homogeneous gas/dust cloud (no rocks) floating in space approaching absolute zero ( $3^{\circ}\text{K}$  Universal background temperature), more than five billion years ago. Figure 1.1 depicts a discussion on the subject of nebular planet formation:<sup>2</sup>

*Furthermore, simulations show that once the putative grain size has reached about 1 metre at a distance of 1 a.u.<sup>10</sup> from the protostar the grains will spiral into the protostar in only 100 years. This is known as the 'metre-sized barrier' to planetesimal formation. However, the latter is proposed as the mechanism that clears out the dusty lanes (orbits) for the planetesimals as seen in Fig. 1. (Fig.1.1)*

*According to the story, these problems can be overcome by either an anomalous jump in density due to a maximum pressure increase at a certain distance from the protostar, or turbulence in the disk regions causing millimetre-sized grains to clump together. Just how either of these could come about is not known. They are introduced a priori, whereby it is assumed that such features exist in real physical systems:*

*"While the mechanism is not yet fully understood, the grains will eventually become kilometre-sized planetesimals."*

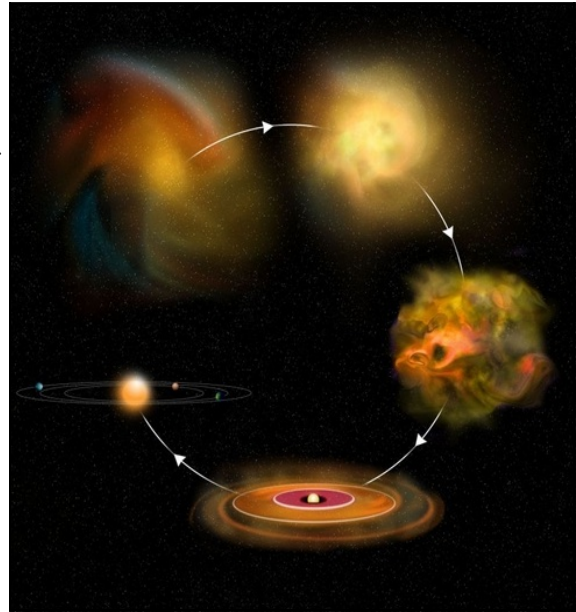


Figure 1.1 - Illustration of the star formation story

- 2 The Solar System cloud was rotating slowly in a prograde direction, and several dust rings started to assemble through electrostatic attraction - akin to 'dust bunnies'. Electro static attraction was initiated by cosmic radiation entering our Solar System and charging individual dust particles with differing amounts of charge. The result was several large scale dust coalescence following Coulomb's Law of electro static attraction.

*Like dust bunnies that lurk in corners and under beds, surprisingly complex loops and blobs of cosmic dust lie hidden in the giant elliptical galaxy NGC 1316. This image made from data obtained with the NASA/ESA Hubble Space Telescope reveals the dust lanes and star clusters of this giant galaxy that give evidence that it was formed from a past merger of two gas-rich galaxies.<sup>3</sup>*

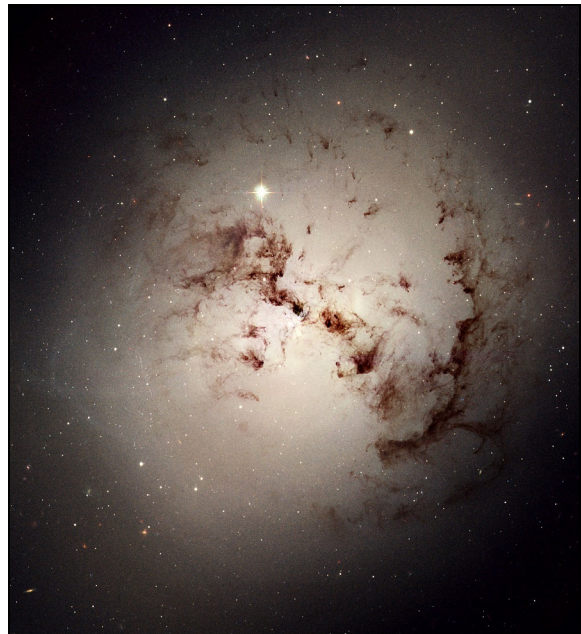


Figure 1.2 - Stellar Dust Cloud

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<sup>2</sup> <http://creation.com/the-naturalistic-story-about-planet-formation>

<sup>3</sup> [www.britannica.com/EBchecked/topic/474302/Precambrian-time](http://www.britannica.com/EBchecked/topic/474302/Precambrian-time)

- 3 Figure 1.3 illustrates how the mass of dust clouds initiated a gravitational collapse in several radial arenas, that served to nucleate a rotating planetary system, similar to that first postulated in 1734, and later refined by Pierre Simon de Laplace in 1796.

*Emanuel Swedenborg. Immanuel Kant, who was familiar with Swedenborg's work, developed the theory further and published it in his "Universal Natural History and Theory of the Heavens" (1755). In this treatise, he argued that gaseous clouds (nebulae) slowly rotate, gradually collapsing and flattening due to gravity and forming stars and planets. A similar but smaller and more detailed model was proposed by Pierre-Simon Laplace in his treatise "Exposition du system du monde" (Exposition of the system of the world), which he released in 1796. Laplace theorized that the Sun originally had an extended hot atmosphere throughout the Solar System, and that this "protostar cloud" cooled and contracted. – However, it was not until the 1970s that the modern and most widely accepted variant of the nebular hypothesis – the solar nebular disk model (SNDM) – emerged. Credit for this goes to Soviet astronomer Victor Safronov and his book "Evolution of the protoplanetary cloud and formation of the Earth and the planets" (1972). the SNDM model has been successful in explaining the appearance of accretion discs around young stellar objects.<sup>4</sup>*

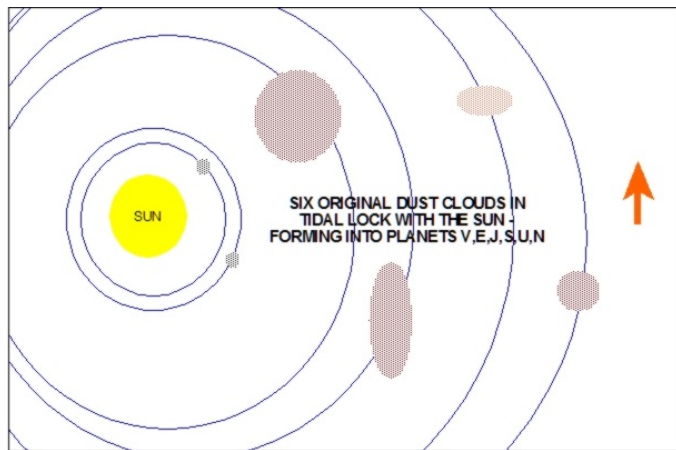


Figure 1.3 - Stellar Dust Cloud Assembles into a Solar System

- 4 Much of the cloud material gravitated to one central core forming the Sun.
- 5 The remaining material (probably <1% of system mass) had angular momentum, and continued to orbit the nascent Sun.
- 6 Orbiting material coagulated in bands covering a radial zone of influence, and related to the angular velocity distribution of matter in the original gas cloud. Bands of dust gradually collected into solid proto planets with angular momentum about the central Sun (sidereal revolution), but with very little solar or axial rotation. See Chapter 2 – Tidal Attraction. The original six proto planets were; Venus, Earth, Jupiter, Saturn, Uranus, and Neptune. Other orbiting bodies subsequently launched from the proto planets.
- 7 Our Sun heated initially through gravitational compression and fission, and subsequently by fusion. Heat from the Sun started warming the planet faces locked by tidal attraction and pointing towards the Sun. The inner planets experienced the most rapid rise in surface temperature. Here surface conditions were gas free and the rocks had low volatility “refractory” types. See Chapter 6 – Moon Rocks.
- 8 Planets also started developing heat from within, through gravitational collapse and radioactivity. See Chapter 3 - Components of Planet Heating. The outer shell remained solid, and the heating interior melted. Magma started to differentiate under the influence of different specific masses. Heating released volatiles from the rocks and increased the planet’s internal pressure. See Chapter 7 – Escape Velocity. Containment afforded by the original, cold, solid planet shell prevented superheated volatiles escaping to the surface.
- 9 The hot planet core met the warming planet face as shown, Figure 3.2 - Asymmetric Heating of Proto-sphere, to form a zone of developing weakness affecting one face of the planet. Volatiles eventually burst through the planet’s ever thinning solid outer shell - provided the planet size was large enough to generate sufficient heat. See Chapter 5 - The Critical Planet Mass. A violent ejection of volatile matter ripped a gaping hole in the planet surface.

<sup>4</sup> <http://www.universetoday.com/38118/how-was-the-solar-system-formed/>

- 10 Remnant/s of that face ejected into satellite or Sun orbit/s, with a quantity of minor particles. Ejected satellite material rapidly cooled adiabatically, after separating from radioactivity heating at the centre of the more massive planets. See Chapter 6 – Moon Rocks. Minor particles formed into orbiting dark coloured rings and on Earth subsequently returned as iron-rich (Fe-rich) meteorites. A turning couple composed of the ejection plume and gravitation force, caused the satellite to orbit the planet, and the planet to develop posigrade solar rotation. See Chapter 8 - Solar Rotation.
- 11 Dark rings also exist at Jupiter, Uranus and Neptune. The initial eruption formed satellite/s composed of primeval planet surface material. Rock masses on some satellites (e.g. Moon) retain parts of the original Earth surface rock, which remain unaffected by reaction with the parent planet's subsequently released volatiles. This feature explains composition differences found in assorted Moon rocks<sup>5</sup>. Some denser satellites retain their original planet surface composition, although continuing lower level internal fission or tidal heating can modify part of the surface. Other less dense satellites common at the outer planets, formed from the steam and rocks ejected after the surface vent opened.
- 12 In summary, the Solar System is derived from a contracting dust cloud, slowly rotating in a posigrade direction. As the cloud contracts the angular velocity of some particles increase until the centripetal force matches the Sun's gravitational attraction. Tidal attraction to the Sun causes the protoplanets to always have the same face pointing inwards. This causes asymmetric face heating while internal nuclear reactions cause heating from within. Eventually, the Sun pointing face can blow out with sufficient force to launch other planets, satellites, and trans-Neptunian objects (TNOs).
- 1.2 GLOBAL DESCRIPTION OF SOLAR SYSTEM MECHANISMS**
- 13 Larger planet mass causes a greater outburst, and increases the likelihood of multiple satellites. Satellite/s or Fe-rich meteorite swarms may blow away from the planet orbit (the gravitational sphere of influence), and enter a Sun orbit. See Chapter 13 – The Solar System Planets.
- 14 A jet of volatiles discharging from the planet face accelerates the planet and strains the orbit's centrifugal force. This alters the planet's sidereal orbit from circular to elliptical. See Figure 8.1 – Common Solar and Satellite Rotation Initiation. The jet of volatiles can persist past the initial separation of the cold outer crust component. Figure 15.7 - Third Stage of Jovian Satellite Development, shows satellites developing retrograde orbits. Inner planet material is of higher density and can be ejected behind the orbiting planet. This material forms solar orbiting planets closer to the Sun, such as Mercury. See Figure 8.3. As the ejection plume continues to rotate, satellites can launch into higher solar orbits in a fourth stage of launch. Figure 15.8 - Fourth Stage of Jovian Planet Development, Pluto and Kuiper Belt Objects are possibly an example for this launch mechanism.
- 15 Some volatiles stay with the parent planet, depending on its mass, and gravitational pull. Other volatiles discharge violently, cool rapidly, and combine with rock fragments to form various low density ice/rock satellites common at the larger planets. Resident volatiles at the host planet stay gaseous and form into a huge cloud making the planet appear several times larger than its compact body. The cloud also acts as an insulating blanket against rapid heat loss from the surface. The cloud helps a complete melt down of the planet surface, and it enters the 'giant planet phase'. Current examples include the sequence Jupiter, Saturn, Uranus and Neptune. Venus also has an insulating blanket, but is due to a different mechanism. See Paragraph 14.2 Venus.
- 16 Initially the planet surface collapses into the hole and quickly fills with molten magma. Eruption continues with rising magma spilling lava onto the broken surface and melting it. This makes the magma hole ever larger. Once the rising magma develops a 'chimney flow' from the centre of the planet, the 'chimney' becomes self sustaining. It remains in the same location relative to the centre of the planet, until exothermic activity effectively ceases at a much later date. See Chapter 4 – Weightless Convection Currents.
- 17 Given sufficient planetary mass (and heat), the hole eventually consumes the entire planet surface. Escaping heat from the planet centre forms an ongoing volcanic event that lasts until radioactivity starts to diminish. Viewed from outer space, this event appears as the red eye near the Jovian equator. Here, only

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<sup>5</sup> Conundrum G.J. Taylor, The Scientific Legacy of Apollo, *Scientific American*, July 1994.



the top of the vulcanism is evident through a cloud of swirling volatiles. The Voyager missions found other 'Eye' structures at Uranus and Neptune as well as significant cloud disturbance at Saturn.

18 Rising magma flows from the Planet Eye and circumnavigates the globe in radiating directions. The dominant stream follows along the equatorial path – due to centrifugal forces associated with the planet's rotation.

19 Lava flows meet on the opposite side of the globe, at a point called the Vortex where flotsam can collect. On Earth, the initial very active volcanic phase lasted 750 My. Flotsam was drawn back into the bowels of the Earth by powerful vortices. No record of this early crustal material survives in a recognisable form today, which might suggest Earth is older than currently estimated.

20 As vulcanism and temperatures decreased, small rafts of floating sialic material began to survive and form into one large raft. The proto crustal material started to collect, floating above the whirlpools of descending denser lava. In this way a continuing elutriation process occurred, which separated sialic materials from primeval lava. This formed into a floating crustal plate consisting of sialic (Si-Al) and sima (Si-Mg) layers.

21 A high density planet core continued to form shown in Figure 1.4 - Eye, Vortex and Permanent Land Formation. The core had a lenticular shape as the convecting currents formed leading and trailing edges to the core aligned with the direction of magma flow. Magma current occasionally entrained blobs of the higher density core material, which carried around and deposited on the shores of the growing Proto Continent.

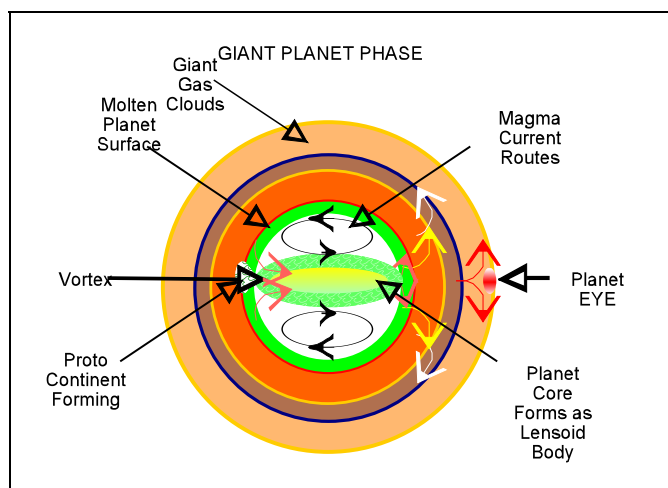


Figure 1.4 - Eye, Vortex and Permanent Land Formation

22 While radioactivity diminished, the sialic raft grew bigger. It formed into a 'dumbbell' shaped Continent – due to the stronger equatorial lava flow. See Figure 9.3 - Protocontinent Plan View. Crustal flotsam piled up along the equatorial belt, before pushing north and south. Massive lateral compressive stresses acted on the Proto Continent as the diameter increased, and lava continued to arrive from all sides. This caused the Proto Continent to sink lower in the mantel, and rise higher into the 'giant stage' atmospheric cloud.

23 Plastic sialic material yielded to these stresses and formed tightly folded, sheared, lithologic sequences commonly found in all Precambrian rocks. The underlying sima layer followed the crenulations producing gravimetric variations present today. Incoming waves of crustal flotsam beached on the shores of the thin proto crustal layers producing the Precambrian greenstone rocks. Precambrian granitic rocks condensed on the underside of the Continent to form greenstone-granite facies of that era.

24 The lava current direction caused high horizontal stress in the upper crustal layers altering to vertical stress in the deeper layers, as the currents moved under the Proto Continent redirected towards the centre of the planet. Residual stresses remain today.<sup>6</sup> Proto Continental mass grew to the extent that Earth's axis of spin became unbalanced. This contributed to a processing component in Earth's spin, which has since slowed to the current period of about 26,000 years.<sup>7</sup>

25 Planet cooling and mountain building continued, until some condensation settled on the highest points of the Proto Continent. This eventually formed torrents causing rapid erosion on the highlands, and massive

<sup>6</sup> Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. p341, p378

<sup>7</sup> [https://en.wikipedia.org/wiki/Axial\\_precession](https://en.wikipedia.org/wiki/Axial_precession)



conglomerate beds on the lowlands. The inception of mobile condensates was a crucial mechanism that rapidly reduced the planet surface temperature and solidified a crust on the lava sea. Condensate flow provided the mechanism by which large quantities of latent heat rapidly convected into the upper atmosphere for radiant dispersion into space. Planets without a high mountain building phase remain blanketed with insulating layers of cloud.

- 26 Vortex currents pulled the plastic crust into local basins that collected considerable thicknesses of volcanic and sedimentary rocks.<sup>8</sup> On Earth the massive Archean cratons formed. Rapid erosion continued until the roots of the Proto Continent reappeared. Deeply buried formations isostatically reached the surface. High residual vertical stresses surrounded by horizontal stresses remain insitu implying a sinkhole origin.<sup>9</sup> The 'giant' planet phase reduced in size while the atmosphere condensed.
- 27 As the hot plastic roots of the Proto Continent penetrated deeper into the molten surface, the descending vortex currents 'plucked' blobs of sialic material from the base of the Proto Continent. See Figure 1.3 – Eye, Vortex and Permanent Land. Some of this material eventually recycled through the centre of the planet, and returned to the surface, via the Eye vent.
- 28 On Earth descending magma associated with the Vortex activity, drew some hot plastic surface layers into localised sinkholes around 200km deep. These were less than 1km in diameter, and initially depressed, filled with fluids, and then heated to great ambient temperatures. The viscous sub crustal layers initially formed into small 'blobs' as the crust was dragged down by the convection currents. Part of the viscous blob subsequently pull away from the under crust. When a 'plucking' event occurred, the down-pull on the crustal layer suddenly released, some magma may have also entered the lower chamber, and the sinkhole retracted isostatically to a higher level. Volatiles within the vent experienced greatly reduced pressures at less depth and rapidly superheated. The contents of the sinkhole became unstable and material violently discharged. Ejection speeds could have exceeded a planet's escape velocities. See: Chapter 7 – Escape Velocity and Chapter 10 – Kinetic Pipes.
- 29 Some silica rich material with associated volatiles could eject into favourable satellite trajectories. This results in continued orbiting of the planet and forms light coloured ice ring structures. Alternately, vented material may be more forcibly ejected into solar trajectories and form into comets or meteorites. Other material falls back to the surface on the Archean western side, as a tektite meteor swarm that on Earth, rapidly eroded away. Meteors with diamonds probably have a Kinetic Pipe origin. Orbiting material forms into equatorial rings through inter-particle gravitational attraction (or adds to preexisting Eye activity rings). Launched rock particles can also be 'shepherded' into rings through the tidal effects of orbiting satellites. This shows most prominently around Saturn, and possibly Neptune. Eventually, orbit decay eliminates the rings with particles returning to the planet's surface as Si rich meteorites. The quiescent sinkhole structures on Earth appear as kimberlite pipe deposits.
- 30 As Earth's surface cooling continued, torrential rain falling on the highlands ran off into shallow seas forming along the Proto Continental margin. Iron and evaporate deposits developed in the seas, under reducing atmospheric conditions. The runoff from the Proto Continent initially flowed towards the Eye where increasing temperatures evaporated the fluids. Volatiles rose high into the giant planet atmosphere in a continuing convection cycle.
- 31 Evaporation and condensation phases accelerated crustal cooling and some thin oceanic crust formed. Radioactivity declined and cooling continued. The seas expanded over the basaltic crust and eventually inundated the Eye spot. Volcanic activity became more spasmodic and submarine. However, the initial major convection point remains as a volcanic island. On Earth, the Eye is just south of the Big Island, Hawaii. This is diametrically opposite the Vortex location and Proto Continent site (and more recently Pangaea – under the Kalahari Desert in southern Africa.
- 32 Descending spiral flows at the Vortex only remained during the height of Eye activity, and while the

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<sup>8</sup> G.J.H McCall, *The Archean – Searching for the Beginning*, Dowden, Hutchinson & Ross Inc. Penn, USA, 1977. p297

<sup>9</sup> Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. p341

surface was molten or plastic. Eventually the descending flow slowed and changed to localised streams of rising convection current. This was due to the insulating properties of the rocky crustal layer combined with a super cooling effect from the encroaching seas on the thin basalt crust. Lower rates of heat dispersion under the Proto Continent created a hot spot (surrounded by a cold halo) that ultimately formed into a rising convection current. Up welling magma fractured the initial Proto Continent on Earth and preempted five or six periods of dispersion and recombination. These phases continued over 3,300 million years and finally developed into the Pangaea Continent about 280 million years ago. Pangaea subsequently fractured along an equatorial bisection forming northern and southern continents of Laurasia and Gondwana, respectively.

- 33 Gondwanaland moved south covering the south pole, under the influence of an equatorial spreading ridge, and Laurasia moved north. Eventually the two sub continents further divided under the same blanket effect mechanisms. A mid ocean ridge persists today at the site of various rising magma flows causing rapid continental separation. When the magma reaches the leading edge of a drifting continent, the flows turn down towards the planet core. Descending magma creates subduction zones most commonly associated with the leading edge of continental drifts. Heat liberated at mid ocean ridges and along subduction zones have a strong influence on Ice Ages and macro weather patterns by influencing local sea temperatures.
- 34 A later stage of planet development sees the separated continents drift around the globe and back towards the Eye, driven by the influence of mid ocean ridge convecting currents. Descending magma current is more likely to accelerate a continent in the direction of an open ocean than towards a continental land mass. The Circum-Pacific ring represents the limits of this stage of drift on Earth today. North and South America approach from the east. Australia approaches from the southwest. Eurasia is moving in from the northwest, and Antarctica is advancing from the south.
- 35 Planet cooling will continue under reduced radioactivity. Surface water will eventually freeze and collect, preferentially at the poles. Highland glaciers will retreat as humidity reduces and ice forms at low altitudes. Sea levels fall, and sea ice advances towards equatorial regions. Finally rivers, lakes, and seas dry up or freeze over, and deep wind blown dust covers the surface. Tectonic activity diminishes.
- 36 The surface might appear as a mosaic of plates separated by deep chasms, due to cooling contraction. Finally, there is a cold planet mainly warmed by solar radiation. This stage of planet development probably does not exist anywhere in the Solar System yet. Planets and satellites of sub-critical masses do not compare, as they follow different orogenic paths.
- 37 This broad sequence of major tectonic events on Earth is useful for postulating a modified geological time scale following the Dynamic Stages of terrestrial development. See, Chapter 12 - Dynamic Geological Time Scale. Dynamic Stages are correlated with equivalent dynamic states for the other planets. See, Chapter 13 - The Solar System Planets, and summarised results illustrated in Figure 23.1 - Planet Mass vs Dynamic Development Stages. The implication is further extended to include other star systems in Figure 23.2 - Planet Dynamic Development Stages vs Star Ages.

## **Chapter 1. Interim Conclusion**

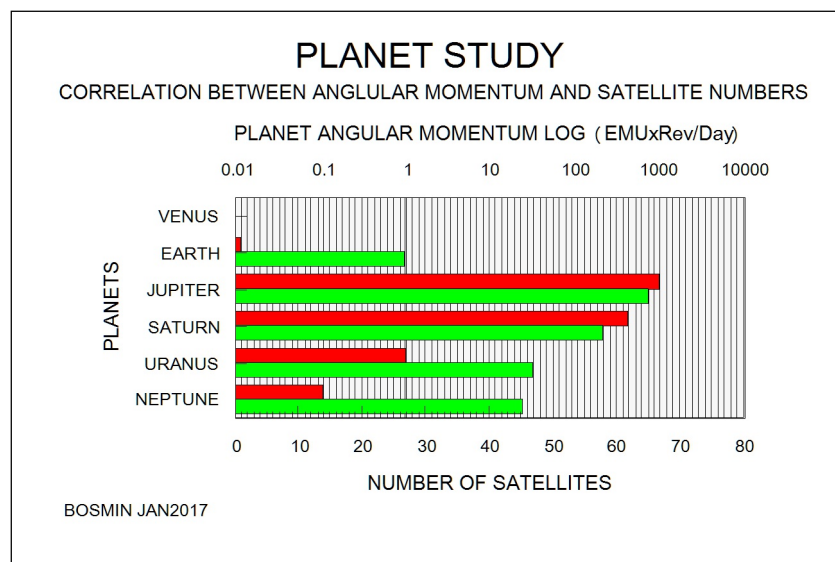
- 1) This treatise adds several dimensions to astrophysics and geology.

## 2 TIDAL ATTRACTION

The intuitive condition for a body forming from a disperse collection of dust particles is that there will be no solar rotation initially present. This is because tidal attraction between the dust particles will quench any axial rotation they might individually possess before agglomerating into the planet mass. Solar rotation in planets caused by meteorite impact is likely to be minor and random. It should have gradually dissipated under the action of gravitational/tidal attraction with the Sun.

Graph 2.1 shows a good correlation between planet solar angular momentum and the number of associated satellites for the six primary planets. This implies there is 'cause and effect' in these two parameters. This treatise suggests solar rotation developed after the dust cloud agglomerated into planets. It was due to the 'Catherine Wheel' effect when large volumes of volatile material blasted through the planet's surface also launching the satellites. See Chapter 8 - Solar rotation.

Limited solar rotation effectively points the same planet face towards the Sun for extended periods. Existing examples of this planetary motion include Venus, although this planet is not in perfect synchronisation with the Sun. The Moon's association with Earth is a text book examples of tidal attraction, and Pluto and Charon (and others) appear to have a similar association. Mercury's association with the Sun is an example of magnetic lock as discovered by Albert Einstein. See Paragraph 13.1. The closest planets and satellites have greater tidal attractions since tidal forces vary as the inverse fourth power of their distance. Many satellites orbit in tidal lock with their planet. Exceptions to this rule include Saturn's satellite, Hyperion which probably interacts with Titan, and the co-orbital satellites Janus & Epimethius<sup>10</sup>.



Graph 2.1 - Planet Mass vs Satellite Numbers

### Chapter 2. Interim Conclusion.

- 1) The larger the planet, the larger is the solar angular momentum and the number of satellites launched.
- 2) Sidereal revolving motion is primeval and reflects the angular momentum of the system's proto cloud. Solar rotation is subsequently acquired, and is predominantly associated with the formation of satellites.
- 3) The further a planet or satellite is from the Sun, the more distorted its rotation and orbit are likely to be.

<sup>10</sup> Abell, Morrison, Wolff, *Exploration of the Universe*, Ed.5, Saunders College Pub. 1987, p360

### 3 COMPONENTS OF PLANET HEATING

The following quotation from Kent C. Condie<sup>11</sup>, highlights important planet heat considerations:

*... All models of Precambrian crustal evolution are closely allied to and dependant upon the Earth's thermal history. The role of plate tectonics in the early history of the Earth is a subject of current debate and discussion and recently the expanding Earth hypothesis has been receiving more attention. Any workable model for the origin of greenstone belts and associated granites must flow logically from the processes which produced the early Archean crust (>3.8 b.y.) and hence it is necessary to review models for the origin and growth of the early crust. Each of these subjects will be briefly reviewed before discussing specific models for the origin of Archean granite-greenstone terrains.*

#### THE ARCHEAN THERMAL REGIME

*Many models have been proposed for the thermal history of the Earth. Most however, have assumed that conduction is a major means of heat transport (Lubimova, 1958; MacDonald, 1959). It is now clear from our knowledge of sea-floor spreading that convection cannot be overlooked in Earth thermal models and indeed most calculations indicate that heat transport by convection greatly exceeds that transported either by conduction or radiation (Elder, 1972; McKenzie and Weiss, 1975). The rate of radioactive heat production (from U, Th, and K isotopes), the distribution of radioactive heat sources with time, and the initial temperature distribution in the Earth are three important parameters in any thermal model. Constraints on Precambrian thermal gradients can be estimated from metamorphic mineral assemblages<sup>12</sup>.*

*The initial temperature distribution in the Earth is not well known. It is dependent upon the timing and the amount of heat contributed by the following (Lubimova, 1958; Runcorn et al., 1977):*

- (1) impacting particles on the accreting Earth which is, in turn, dependent upon particle velocity distribution;*
- (2) gravitational energy released by the interior of the Earth as it grows;*
- (3) accumulation of radiogenic heat primarily from short-lived radioisotopes such as <sup>26</sup>Al and <sup>244</sup>Pu;*
- (4) inductive heating resulting from intense solar wind activity; and*
- (5) core formation.*

*Although the relative contributions of each of these heat sources is not well known, it appears that there was sufficient heat available to produce extensive melting of the early Earth.*

The list of five heat sources omits radiated heat from the Sun. In the event that a planet continues to present one face to the Sun for an extended period, the solar face will become hotter than the remote face. The surface temperature will depend on the planet's proximity to the Sun. Over time, conduction will develop a thermal gradient penetrating deep into the planet surface. Figure 3.1 – Asymmetric Heating of Proto-sphere.

Conversely, relatively localised heat generated from small to medium sized impacting particles, will have a shallow base with steep thermal gradient to the planet surface. The heat therefore, will quickly conduct, or radiate to the surrounding atmosphere. A larger particle may penetrate the planet surface and amalgamate with the hot inner core, in which case the heat will remain. This style of heat infusion is probably a relatively rare spasmodic occurrence and has a relatively minor effect on total planet heat. However, should the larger particle impact the Earth sea surface, it could have a dramatic effect by temporarily releasing large quantities of carbon dioxide gas to the atmosphere, with associated impacts on air breathing fauna, but not on total planet heat.<sup>13</sup>

This treatise postulates that the Earth's crust was completely molten for a considerable time, after the Moon

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<sup>11</sup> Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. pp313-314

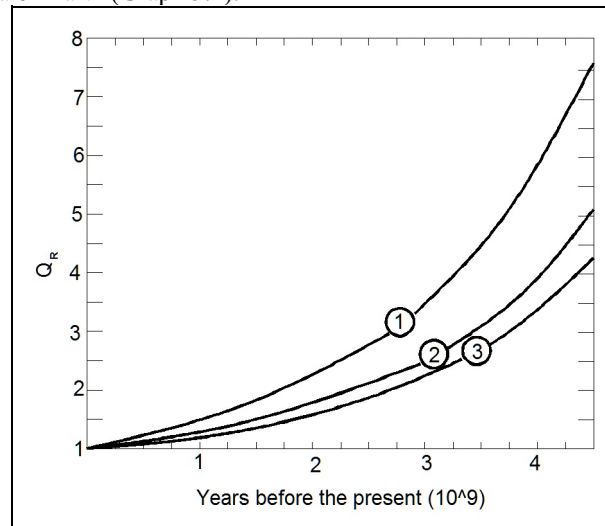
<sup>12</sup> Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981

<sup>13</sup> [www.bosmin.com/SeaChange.pdf](http://www.bosmin.com/SeaChange.pdf) - RA Beatty

separated from Earth. Convecting magma currents fixed the location of the Proto Continent See Figure 1.4 Subsequent Continental drift was due to a geometric rearrangement of convection currents. This is attributable to the 'blanket effect', and the diminishing rate of heat evolution from within the Earth.

In accepting this premise, points (2) and (3) in the preceding quotation have most influence, other than solar heat. Gravitational heat component is probably an initiating phenomenon most apparent at very early stages of planet agglomeration. It probably creates sufficient heat to initiate core formation with the associated settling out of the more dense magma. However; unless heating continues, core formation will cease.

Various fission activities produce heat as a by product and may occur at very low (absolute zero) temperatures. The rate of dissipation and the quantity of fission heat at any point in time, is proportional to the planet size. With the passage of time, the rate of heating should subside as radioactivity decreases. The work by Dickinson and Luth helps to describe these phenomena on Earth (Graph 3.1).



Graph 3.1 - (Fig 10-1) Archean Greenstone Belts

Fig. 10-1. Variations in heat generation in the earth as a function of time<sup>14</sup>.  $Q\sim$  = ratio of heat production at any time in the past to that currently observed.

Models: 1 = chondrite, 2 = carbonaceous chondrite, 3 = Wasserburg model with K/U and Th/U = terrestrial values.

It is possible to calculate the rate of heat production in the earth as a function of time for various estimates of the U, Th, and K concentrations in the earth. Examples of such rates for three different earth compositions are given in Fig. 10-1 .... Recent estimates of the composition of the earth suggest that models 2 or 3 are probably more realistic than the chondritic model 1. It is clear from the figure that heat production increases dramatically in the geological past and that even in the late Archean (2.5 b.y.) the heat generation was at least twice the present value<sup>1</sup>.

A small planet contains low quantities of nuclear fuel. The proximity of the surface effectively dissipates heat through conduction processes.

A larger planet has vast quantities of nuclear fuel, giving off much heat. This only dissipates slowly through conduction. Heat buildup will eventually result in rock meltdown followed by convecting currents carrying hot magma towards the cooler planet surface before returning to the hotter inner core. This process also allows differential settling to occur. Heavier minerals sink towards the centre of the planet and lighter volatile products rise towards the surface. Rising magma can provide conditions for rapid steam super heating. See Section 7 – Escape Velocity, and Section 8 – Solar Rotation.

<sup>14</sup> after Dickinson and Luth, 1971; copyright © 1971 by the American Association for the Advancement of Science

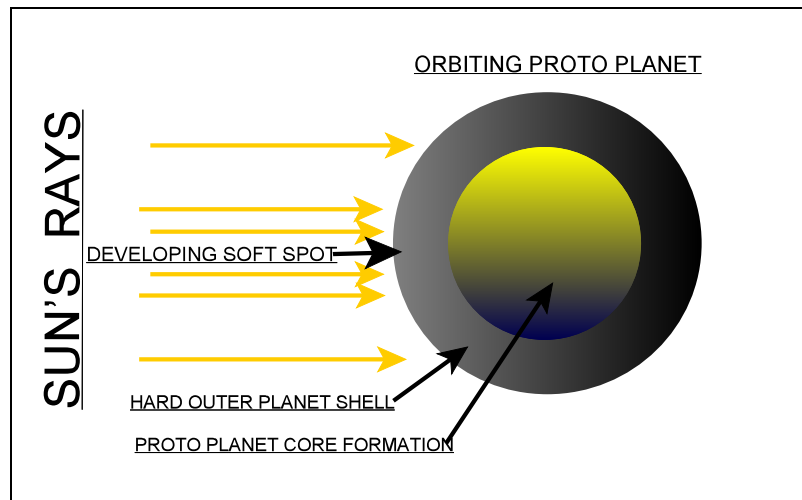


Figure 3.2 - Asymmetric Heating of Proto Planets

### Chapter 3. Interim Conclusions:

- 1) The Sun's rays on the solar side of the Earth, before lunar separation occurred, was a critical external heating event in the Earth's history.
- 2) Internal sources of planet heat associated with convection are the most significant tectonic motivating forces in the post lunar separation period.

## *WEIGHTLESS CONVECTION CURRENTS*

This treatise proposes that a rising magma column, developed during the Eye Dynamic Stage, Figure 1.4, maintains its position relative to a planet's core, over time.

The proposition that rising currents of magma maintain a fixed position on a liquid planet surface – can be tested by positioning an oil sphere on a resistance wire under conditions of weightlessness. As an electric current heats the wire, the oil flows in convecting loops. These should radiate spherically outwards, until the surface tension of the oil is broken at one spot (the Eye). Subsequently, the heat convection always favor rising to the spot where the surface tension was first ruptured, until thermal activity subsides to a low level. Convecting currents should circumnavigate the oil sphere and return to the centre at a diametrically opposite position (the Vortex).

The Eye may be at any point on the surface. By axially spinning the oil sphere during the heating process, the denser (colder) oil should migrate to the equatorial boundary. This forces the hotter oil towards the poles where an Eye spot can develop. This convection symmetry will probably modify in favor of an equatorial Eye site by adding some sidereal motion, and external radiated heat input. This raises the possibility of a potential Eye spot anywhere on the planet's surface, depending on the balance between external radiated heat, axial and sidereal rotations.

In planets close to the Sun, the initial Eye site forms due to the external softening effects of the Sun's rays near the equatorial boundary. Volatile discharge from the Eye spot can cause axial rotation. (Note exception Paragraph 14.2 Venus). The distant planets Uranus and Neptune, show the effects of lower solar heating. See Chapters 19 and 20. This reduced influence results in axial orbits with the highest inclinations at  $82^{\circ}5'$  and  $28^{\circ}48'$  respectively.

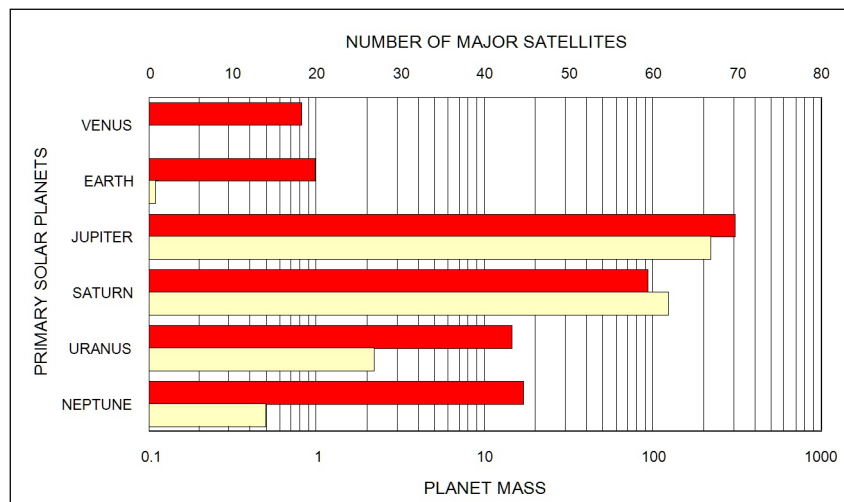
### **Chapter 4. Interim Conclusion**

- 1) A Sun's constant radiation on one face of a protoplanet in tidal lock with the Sun has the potential to cause an eruption capable of launching satellites from the protoplanet, and imparting solar rotation to the planet.
- 2) Planets Uranus and Neptune are far enough away from the Sun to exhibit unusual solar and satellite orbiting sequences.

## CRITICAL PLANET MASS

The size of a planet is proportional to the quantity of atomic material available for planet heating and tectonic activity. Small planets or satellites, heat sufficiently to liberate volatiles in a non explosive way. Surface meltdown may be partial or non existent.

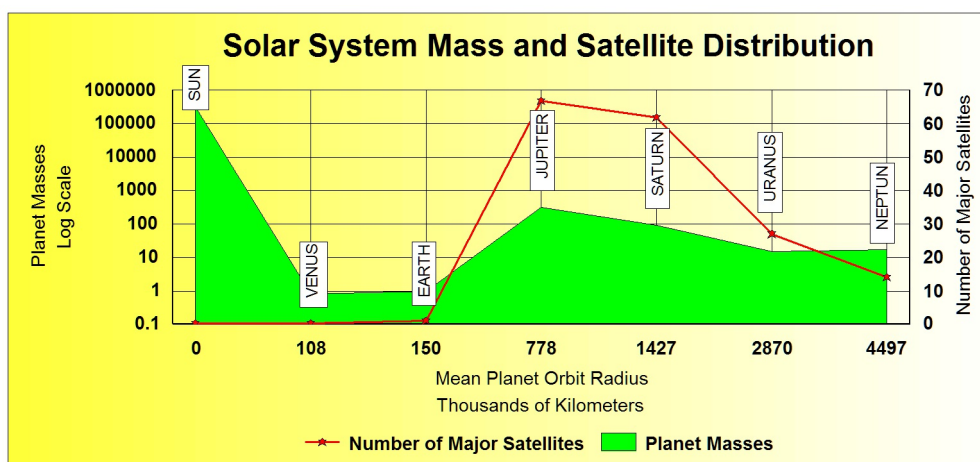
A larger planet generates sufficient radioactive heat to explosively eject one or more satellites. Initial core heating will expand the solid material and compress any volatiles present. A cold, solid exterior shell of the planet retains pressure. Continued heating causes melting and can lead to super heated steam forming in sufficient quantity to rupture the outer shell. This can result in fragments ejecting at super critical speeds. The cut off size for these activities might be a planet with mass less than Earth's, but larger than Venus, which is 0.815 of Earth's mass. An association between planet size and number of satellites launched shows in Graph 5.1.



Graph 5.1 – Correlation between Planet Size and Satellites

The correlation is limited by the exceptions of:

- ☐ Mars with satellites Deimos and Phobos. These appear to have a different origin to the rest of the satellites. See Paragraph 15.1 – Mars.
- ☐ Similarly Mercury, and Pluto with associated satellites may also have a satellite rather than a planet origin, See Paragraphs 14.1 – Mercury, and 21.1 – Pluto.



Graph 5.2 – Solar System Mass Distribution and Satellites

Graph 5.2 shows the Solar System mass distribution with the Sun representing the great majority of mass. Planets with mass greater than Venus all have satellites, with the larger planets generally having more satellites.



## 5.1 ARCHEAN THERMAL BULK IN SUPER CRITICAL MASS PLANETS

We test Earth as a model of the least thermal mass required to initiate a satellite launch. (See Section 7 – Escape Velocity). Table 5.1 shows the logic adopted:

- ☐ The analysis is of Earth's structure in 500km depth increments.
- ☐ Estimates of density at each depth come from equations (7.2 & 7.3)
- ☐ Pressure at each depth is set from (7.4) based on the mean density to that depth.
- ☐ Steam Point temperature (7.12) is found from the pressure at a particular depth.
- ☐ The Specific Heat of rock varies from 0.1 for silica to 0.2 for iron. A straight line relationship simulates the surface to the core, using this value range.
- ☐ Total Energy is given by Steam Point Temperature times Specific Heat.
- ☐ Heat Energy at depth is Total Energy by Density (j/kg).
- ☐ Global volume and mass increments in onion rings structures at nominated depths.
- ☐ Incremental Heat Energy is the product of Mass times Heat Energy at depth.
- ☐ A least squares combination of these values shows they approximate:

$$4.266 \text{ E}+25 \times \text{Depth}^{(0.18)} \quad (5.1)$$

### To Calculate Earth's Total Energy Pool When Heat Flux Matches Steam Point Temperatures

Radius of Earth	m	6,378,000													
	Inc	500,000													
Cover Depth (m)	m	1	500001	1000001	1500001	2000001	2500001	3000001	3500001	4000001	4500001	5000001	5500001	6000001	
Density @ Depth (set 1m=2.2)		2.2	2.00	4.63	4.84	4.97	5.47	7.58	9.30	10.76	11.43	11.78	12.15	12.53	12.92
Mean Density @ Depth	p	2.10	2.94	3.42	3.73	4.02	4.53	5.13	5.75	6.32	6.82	7.26	7.67	8.04	
Pressure @ Depth	psi	17.67906	2088186.93	4849507.65	7934262.99	11403230.3	16058619.5	21811298.1	28556075	35856854	43510484.2	51498371.3	59810265.6	68441375.4	
Steam Point Temperature	T (°C)	99	2,589	3,276	3,758	4,159	4,576	4,984	5,374	5,726	6,044	6,336	6,606	6,859	
Specific Heat Variation @ Depth	SpHt	0.10	0.11	0.12	0.12	0.13	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.19	
Total Energy	CHU	10	279	379	464	546	637	733	832	932	1,031	1,130	1,230	1,331	
Heat Energy @ Depth	j/kg	41,581	1,169,369	1,587,089	1,944,365	2,288,152	2,667,925	3,069,709	3,486,014	3,902,842	4,317,940	4,734,042	5,152,922	5,575,797	
Incremental Globe Volume	m³	5.112E+014	2.361E+020	1.991E+020	1.654E+020	1.347E+020	1.072E+020	8.283E+019	6.161E+019	4.352E+019	2.858E+019	1.678E+019	8.126E+018	2.609E+018	
Incremental Globe Mass	kg	1.022E+015	1.094E+021	9.643E+020	8.217E+020	7.371E+020	8.127E+020	7.707E+020	6.63E+020	4.974E+020	3.368E+020	2.039E+020	1.018E+020	3.37E+019	
Incremental Heat Energy	joules	4.251E+019	1.279E+027	1.53E+027	1.598E+027	1.687E+027	2.168E+027	2.366E+027	2.311E+027	1.941E+027	1.454E+027	9.654E+026	5.246E+026	1.879E+026	
Incremental Heat Energy (formula)	j	4.266E+025	4.527E+026	5.129E+026	5.517E+026	5.81E+026	6.049E+026	6.25E+026	6.426E+026	6.583E+026	6.724E+026	6.852E+026	6.971E+026	7.081E+026	
Total Planet Critical Heat (by integration)	Mj	3.87E+027													

Table 5.1 – Heat Flux Calculations

Integrating this expression, calculates the total heat from the surface to Earth's centre:

$$\text{Total planet energy} = \int_0^{(R=6.38E+6)} (4.266E+25)^{0.18} dx \quad (5.2)$$

$$= \left[ (4.266E+25)^{0.18} dx \div 1.18 \right]_0^R$$

$$= 3.87E+27 \text{ MJ} \quad (5.3)$$

It seems probable that planets with this heat flux (or possibly a few percent less than Earth's) could launch satellites in Archean times. A similar calculation for Venus shows the critical Heat Flux range is between 3.87 to 3.64E+27 MJ.

The larger the planet the longer this phenomenon lasts. Planets Jupiter, Saturn, Uranus and Neptune are possibly in this state today. Earth's heat flux was at this level in Archean times (see Graph 7.1), but has since decayed below this critical heat value. (See Graph 7.2).

Planets of Super Critical Mass are, in ascending order, Earth, Uranus, Neptune, Saturn and Jupiter. All the other Solar System bodies appear to have insufficient bulk to effectively propagate through satellite launch and surface meltdown phases and are therefore of Sub Critical Mass.

## Chapter 5. Interim Conclusion

- 1) Earth is the smallest planet with sufficient inherent energy to launch satellites.

## 6 MOON ROCKS

Various Apollo moon missions since 1969 provided scientists with rock specimens used to form a clearer picture of the Moon's origin. An excerpt broadly summarises this thinking:<sup>15</sup>

*During this time (3.8 B.y.), slow heating deep in the interior by pockets of trapped radioactive elements caused localised melting. These magmas rose to the surface so that the lava floods began, filling up craters and ringed basins and flowing far across the face of the Moon. Lava flows continued sporadically for hundreds of millions of years. The last flows dated by isotopic dating techniques have ages of about 3200 million years. Some 97 per cent of the rocks on the surface of the Moon formed before 3500 million years ago. In contrast a similar proportion of the rocks exposed on the Earth's surface are younger than 3500 million years. During most of geological time on Earth, the Moon has looked much as it does today.*

A more detailed account of the Earth/Moon chemical differences is from:<sup>16</sup>

*The Apollo program provided a new test. If the moon split from the earth in this manner (moon spun off – after George Darwin, the fission hypothesis), it ought to have exactly the same composition as the earth's rock material near the surface (specifically the crust and mantle). The moon and the earth do have identical amounts of oxygen isotopes, which indicates that the two bodies are related in some way. But the compositional similarity ends there. Crucial data came from lunar samples, a network of seismometers left behind and spectroscopic studies by the Apollo 15 and 16 missions. They enabled researchers to conclude that the moon and the earth have different chemical compositions.*

*For example, the moon has much less volatile material – substances that boil away easily – than does the earth's mantle. The satellite completely lacks any water-bearing minerals: it is bone-dry. It also lacks other kinds of volatile elements, from common ones such as potassium and sodium to more exotic chemicals such as bismuth and thallium. Scientists also discovered that the moon is enriched in nonvolatile substances relative to the earth. Called refractories, these elements are the opposite of volatiles they boil at high temperatures. It appears that refractories such as aluminum, calcium, thorium and the rare-earth elements are present in the moon at concentrations that are about 50 percent higher than those in the earth. Another bit of damaging evidence against the case for fission comes from the ratio of iron oxide to magnesium oxide. The ratio of these common compounds seems to be about 10 percent higher in the moon than it is in the crust and mantle of the earth.*

These properties are consistent with the Moon separating from Earth sometime before 3.5 B.y. ago. The Moon swiftly became geologically quiescent about 3.2 B.y. ago due to fairly rapid cooling. During this period the Earth started a very active phase of heat engendered geological activity.<sup>17</sup>

### ***The Fission Hypothesis***

*This suggests that shortly after the Earth separated into core and mantle, part of the silicate mantle was either spun off, or knocked off by a large impact – to form the Moon. The main point in favor of this hypothesis is that the bulk density of the Moon is close to that of the silicate mantle of the Earth.*

*If the fission hypothesis is correct, then the bulk composition of the Moon should be the same as that of the silicate mantle of Earth. However, there are some significant differences. The total Moon appears to contain more iron and less magnesium than the Earth's mantle (for example, there is 13% iron oxide in the Moon compared with 8% in Earth's mantle). The Moon is also deficient in lead but somewhat enriched in calcium, aluminium and uranium compared to Earth. Thus there are significant chemical differences between the Earth and the Moon, which makes it unlikely that the Moon formed directly from the Earth.*

The chemical differences quoted above, presupposed that the Earth's silicate mantle was in place at the time when the Moon separated. Further it presupposes no further changes occurred to the Earth's mantle after the lunar separation. This treatise suggests that the main Earth mantle changes occurred after the Moon's departure, and that the sialic layers of crust had not yet formed on Earth.

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<sup>15</sup> I.F. Clark & B.J. Cook. *Geological Science – Perspectives of the Earth*, Tien Wah Press, Singapore, 1986, p58

<sup>16</sup> G.J. Taylor, *The Scientific Legacy of Apollo*, Scientific American, July 1994, pp26-33

<sup>17</sup> I.F. Clark & B.J. Cook. *Geological Science-Perspectives of the Earth*, Tien Wah Press, Singapore, 1986, p59-60

The remote side of the Moon consists of lower density rock while the near side is partly composed of the higher density lava flood material. This is consistent with gravitation attraction with the Earth attracting higher density material to the Moon's near surface, while the Moon was still at a fairly plastic stage.



Figure 6.1 Near Side and Far Sides of the Moon - after NASA

Following the Moon's departure, the Earth's mantle underwent a complete melt down followed by an extended period of elutriation. During this period dense iron portions of the proto mantle transferred to the central iron core reducing the percentage of iron at the surface. Magnesium ultimately concentrated in the Sema layer, which was not present when the Moon separated. Other chemical variations may be due to elutriation effects, water, and weathering differences between the two bodies.

#### **Chapter 6. Interim Conclusions:**

- 1) The Moon's highland surface represents how the Earth's surface used to be.
- 2) The lunar mare areas are limited volcanic lakes formed after the Moon separated, and before all the heat supplied by the Earth had diminished. Some are the result of meteor impact penetrating the thin crust and into the molten magma layer.
- 3) Gravitational attraction to the Earth pulled higher density magma material to the Moon's near surface, while the Moon was still in a fairly plastic state.

## 7 ESCAPE VELOCITY

Material leaving the surface of the Earth on a trajectory for orbital rotation, must first accelerate to orbiting speed. The minimum value is 8.0 km/sec and provides a circular orbit. At faster speeds, material enters an elliptical path. With frictionless tangential speeds greater than 11.18 km/sec, material exceeds Earth's escape velocity entering a parabolic or hyperbolic path, and never returns.<sup>18</sup>

The general equation for escape velocities is:

$$V_{esc} = (2GM/r_o)^{1/2} \quad (7.1)$$

Where G is the gravimetric constant  $6.675 \times 10^{-11}$  (mks units), M is mass of the planet, and  $r_o$  is the mean radius of escape.<sup>19</sup>

At Jupiter the escape velocity is 59.6 km/sec.

### 7.1 KIMBERLITE PIPES

There is limited knowledge of kimberlite pipe formation, other than that the pipes are very deep, with comparatively small cross sections, but they are generally 'carrot' shaped, tapering with increasing depth. See Figure 10.2 It is possible to predict ambient conditions in some pipes where diamonds form. Diamonds require temperature and pressure thought to exist at least 200km deep.<sup>20</sup> Continental crust currently reaches a maximum of only 65 km deep below some mountains.<sup>21</sup> This gives an idea of the altered terrestrial conditions since the time that diamonds formed in kimberlite pipes.

### 7.2 DENSITY, PRESSURE, AND TEMPERATURE ALGORITHMS

Reference is made to tabulations for increasing temperature and density against increasing depth on Earth.<sup>22</sup> Formulae to simulate these relationships include:

$$\text{For } D < 3,000 \text{ km:} \quad p = 2.41 e(4.66E-7 \times D) \quad (7.2)$$

$$\text{and for } D > 3,000 \text{ km:} \quad p = 8.94 e(6.13E-8 \times D) \quad (7.3)$$

Where D is depth from the surface in metres, e is base of natural logarithm, and p is insitu density.

The ground pressure associated with increasing density comes from the average overlying density ( $\rho'$ ) and the depth:

$$psi = 14.7 + D \times 3.28 \times 62.28 \times \rho' \div 144 \quad (7.4)$$

Note:<sup>23</sup> The total pressure P inside a planet is governed by the gravitational attraction – not by the equation of state ie:

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<sup>18</sup> Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 1983, Ed.5, p17, and See Per Com. Section 16 Dr Andrew J.R. Prentice, Monash 1/12/88, and Refer Collins Gem, *Basic Facts Physics*, Orbit, 1988.

<sup>19</sup> Ferdinand P. Beer, E. Russell Johnston, Jr., *Vector Mechanics for Engineers*, Simetric Ed. DYNAMICS, McGraw Hill, 1981, eqn.12.43)

<sup>20</sup> Lefond, *Industrial Minerals and Rocks*, 4th. Ed. Mudd Series, Society of Mining Engineers, 1975 p.594

<sup>21</sup> David Lambert, *The Cambridge Guide To The Earth*, Cambridge University Press, 1988. p.44

<sup>22</sup> IF. Clark, B.J. Cook, *Geological Science – Perspectives of the Earth*, Australian Academy of Science, Canberra, 1986, p370

<sup>23</sup> After Professor Andrew J.R. Prentice

$$\frac{dP}{dr} = \frac{-\rho GM(r)}{r^2} \quad (7.5)$$

However, for comparatively shallow depths this effect is not great and can be ignored.

Ground temperature in degrees centigrade is:

$$\text{For } D < 2,000 \text{ km:} \quad ^\circ\text{C} = 598 \times D^{(0.102)} \quad (7.6)$$

$$\text{and } D > 2,000 \text{ km:} \quad ^\circ\text{C} = 1707 \times \ln(D) - 21830 \quad (7.7)$$

### 7.3 GROUND TEMPERATURES

*Ancient temperatures at 200 km deep were possibly 3,000°C or even 4,000°C – given that geotherms in the Archean crust were probably steeper than that characteristic of average Continental crust today.*<sup>24</sup>

Simulations of the higher Archean temperatures are:

$$\text{For } D < 90 \text{ km:} \quad ^\circ\text{C} = (25 + 0.012 \times D) + 0.99 + (0.011 \times D) \quad (7.8)$$

$$\text{or } D < 1,250 \text{ km:} \quad ^\circ\text{C} = (598 \times D^{1.102}) + 1500 \quad (7.9)$$

$$\text{and } D > 1,250 \text{ km:} \quad ^\circ\text{C} = (1707 \times \ln(D)) - 21830 + 1500 + (2.63\text{E-}4 \times D) \quad (7.10)$$

Currently the temperature at 200 km depth is in the order of 2,000°C. These large temperature differences over time, greatly affect the ejectile capabilities of the planet. Heat Engine theory can quantify these differing states.

### 7.4 HEAT ENGINE THEORY

Steam tables for very high temperatures and pressures were not readily available and a least squares combination extended the range of existing tabulations.<sup>25</sup> Formulae in FPS units are:

$$T^\circ = 44.52 \times \text{psi} \quad (7.11)$$

$T^\circ$  is the steam point temperature at a given pressure in psi.

$$\text{LH} = 597 - (24.35 \times \ln(\text{psi})) \quad (7.12)$$

LH is the latent heat in Calorific Heat Units (CHU) at given psi, and;

$$\text{TH} = 613.38 \times \text{psi}^{(0.016)} \quad (7.13)$$

TH (or IH) is sensible heat plus latent heat in CHU at a given psi.

$$\text{IH} = 578.22 \times \text{psi}^{(0.013)} \quad (7.14)$$

IH is internal heat (after expanding TH to atmospheric pressure) in CHU at a given psi.

---

<sup>24</sup> Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. p315

<sup>25</sup> Eric De Ville, *Heat Engines*, Teach Yourself Books, English Universities Press, London, 1960, p164

## 7.5 USING CURRENT TEMPERATURE CONDITIONS AT 200KM:

The pressure is 1.06 Mpsi and steam point temperature is: (From 7.11) = 2,145°C

Ground temperature at this depth is: (From 7.6) = 2,081°C

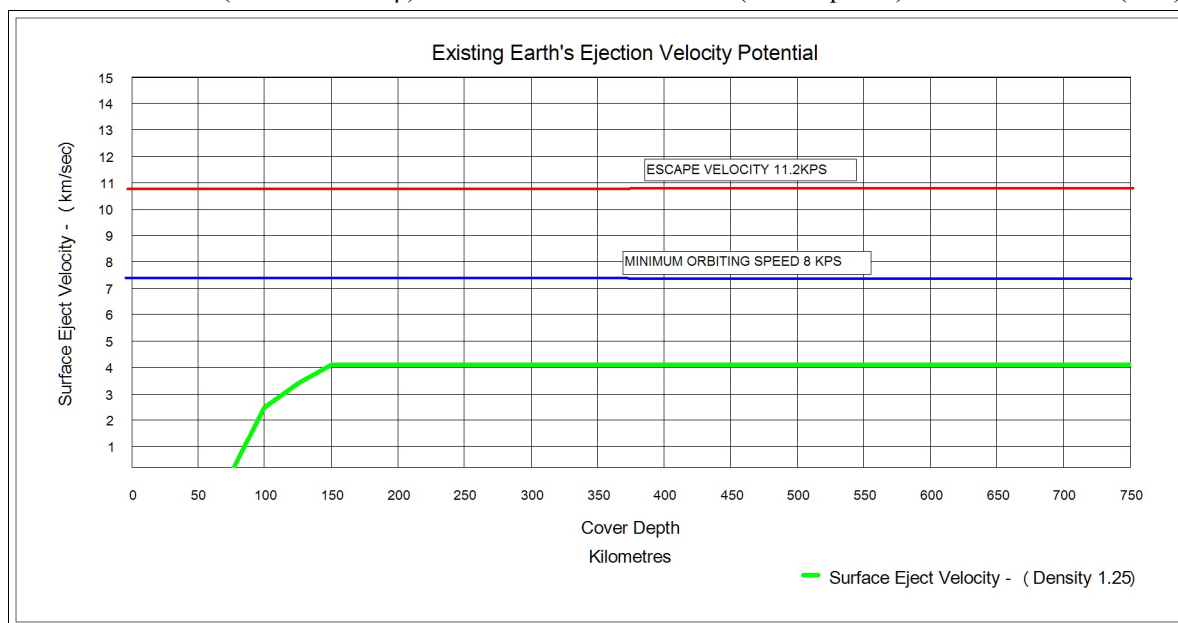
Superheat is:  $2,081^{\circ}\text{C} - 2,145^{\circ}\text{C} = -64^{\circ}\text{C}$

(Negative means there is no superheat under these conditions.)

The cumulating energy down to 200 km depth is in the order of 10.4 MJ/kg. If instability occurs in this column of energy and pressure releases, the energy becomes kinetic. At mass density  $\rho = 1.25$ , and excluding efficiency loss, the velocity is:

$$\text{Kinetic Energy} = \frac{1}{2} \rho V^2 \quad (7.15)$$

$$V = (2 \times 10.4 \text{ E}+6 \div \rho)^{\frac{1}{2}} = 4.09 \text{ km/sec (See Graph 7.1)} \quad (7.16)$$

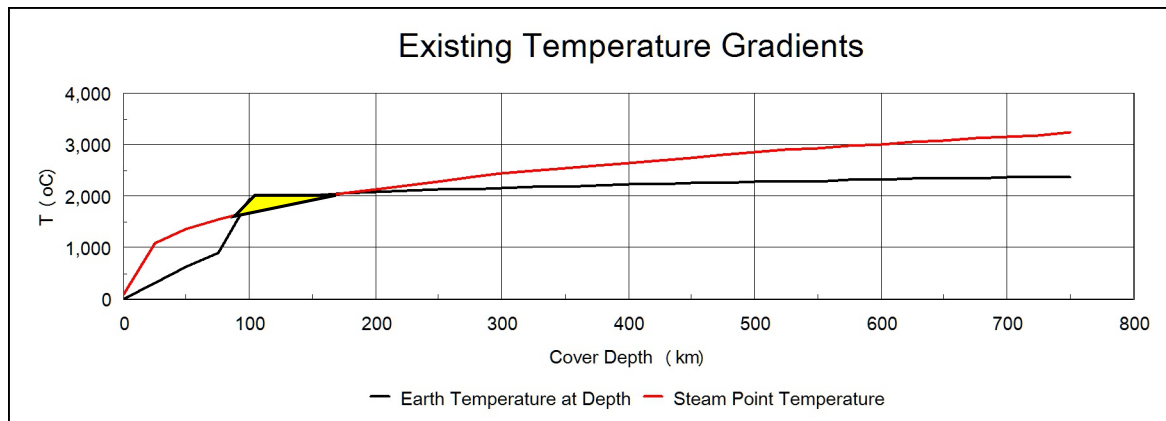


Graph 7.1 – Existing Eject Velocities & Cover Depths on Earth

Temperature versus depth conditions in Graph 7.2, show the Earth's internal temperature gradient below the steam point line for increasing depths. The small exception is at depths between 100 and 150 km where the two graphs interpose and limited superheat conditions exist. Pressure from superheated steam is kept in check by overlying rocks. These occasionally rupture forming volcanoes or geysers, and built-up internal energy vents to the atmosphere.

Even material raised from depths over 600 km is unlikely to significantly add to the projection velocity. This remains capped as the superheat energy shows only a very slow rate of increase under existing adiabatic conditions.

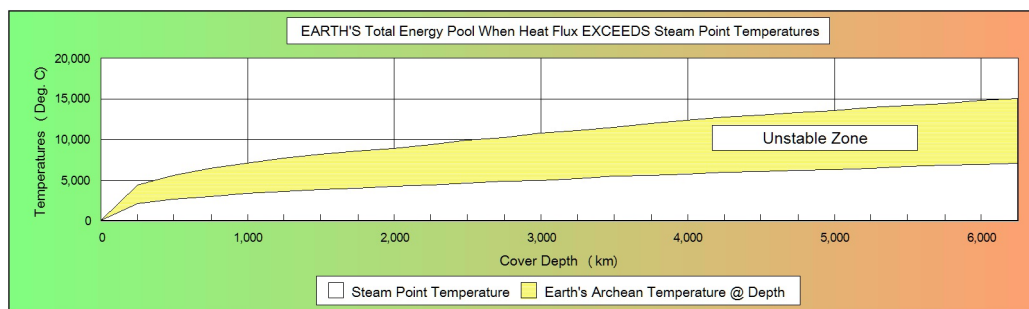




Graph 7.2 – Current Temperature Gradients on Earth

### 7.6 ARCHEAN TEMPERATURE CONDITIONS AT 200 KM DEPTH

The Archean ambient ground conditions provided many opportunities to vent large quantities of superheated steam energy from below Earth's surface. Graph 7.3 illustrates this where the temperature curve is consistently above the steam point curve.



Graph 7.3 – Archean Temperature Gradients on Earth

Using similar logic to that developed previously for 200 km depth:

The pressure was 1.06 Mpsi and steam point temperature was (from 7.9) = 2,145°C

Archean ground temperature at this depth was (from 7.6) = 3,581°C

There were 3,581°C – 2,145°C = 1,436°C of superheat, or SE = 1,436 CHU/lb.

(This assumes Specific Heat of steam is unity. Steam Sp Ht actually ranges 0.5 to 0.64 depending on the temperature).

$$\begin{aligned}
 \text{Internal Energy (IE)} &= \text{SE} + \text{IH} \\
 &= 1,436 + (\text{from 7.14}) \\
 &= 1,436 + 695 \\
 &= 2,131 \text{ CHU/lb}
 \end{aligned}$$

Internal Energy was:

$$\text{or } 2,131 \text{ CHU/lb} \times 1.8011 = 3,838 \text{ BTU/lb}$$

$$\text{or } 3,838 \text{ BTU/lb} \div 430 = 8.93 \text{ MJ/kg.}$$

The energy released at increasing depths will depend on the shape, depth and volume of the underlying cavity. This exercise assumes the cavity consists of a series of connected chambers at 25 km depth intervals, each with unit volume capacity. Sitting atop these chambers is a unit volume of material with varying density. The cumulating energy down to 200 km depth was in the order of 51.0 MJ/kg. When instability occurred in this column of energy and pressure released, the energy converted into ejection velocity. At density  $\rho = 1.25$  and assuming no energy loss,

we get from (7.16):

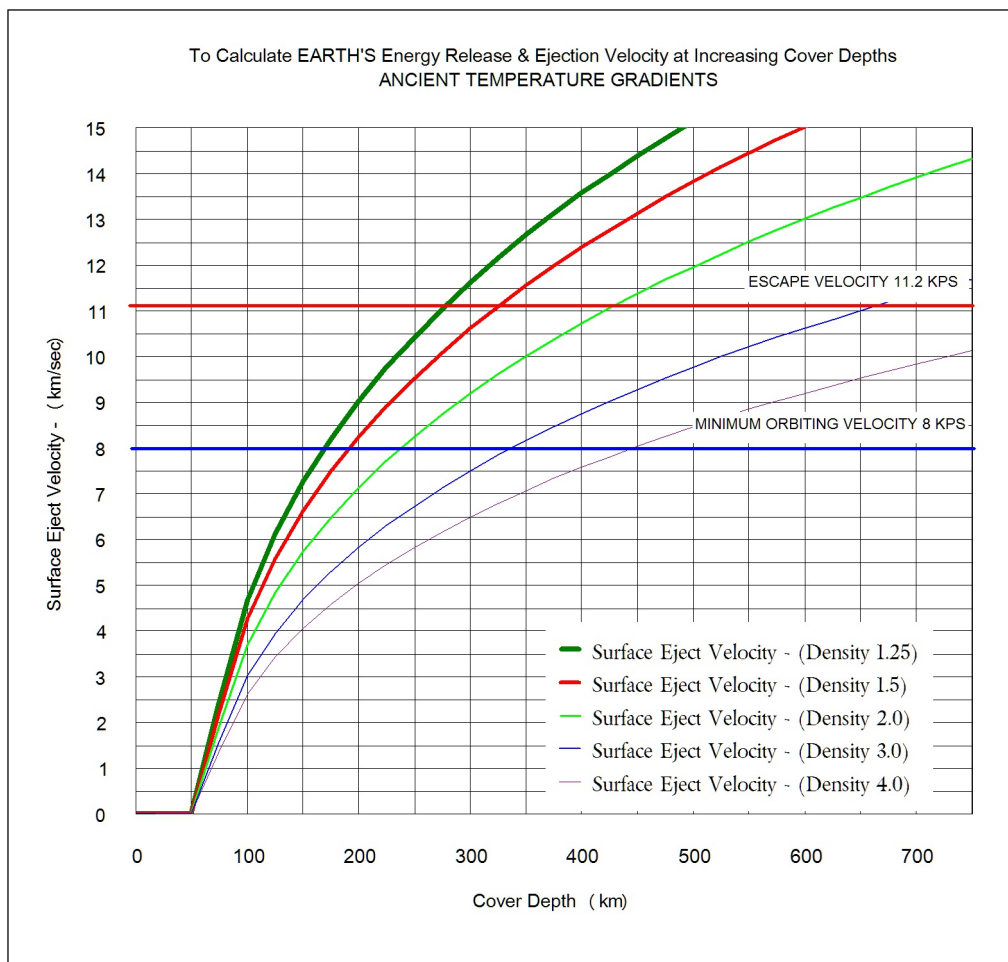
$$V = (2 \times 58.8E+6 \div p)^{1/2} = \mathbf{9.04 \text{ km/sec}} \quad (7.17)$$

Comparing the two velocities at 7.16 and 7.17 shows (Graph 7.1) why ejected material could attain Earth orbit speeds during Archean times, but now cannot reach orbiting launch speed.

Graph 7.4 illustrates various Archean satellite launch possibilities at particle densities ranging from 1.25 to 4.0.

At deeper depths, or with a more continuous water column, there was considerable potential for some pipe discharge material to exceed the Earth's escape velocity of 11.18 km/sec. This may in turn provide a possible explanation for the source of comet bodies, or planet ring structures. A parallel line of logic suggests that rising magma with entrained volatiles, will undergo similar pressure reductions. This results in the release of super heated gases and huge quantities of energy.

Planets large enough to develop a temperature-depth profile sufficiently intense to exceed the steam point loci (Graph 7.3), will be of Super Critical Mass. See Chapter 5 – Critical Planet Mass.



Graph 7.4 – Archean Projectile Velocity Estimates for Earth



### **Chapter 7. Interim Conclusions**

- 1) The Earth's heat content during the Archean was sufficient to launch satellites at orbiting and escape velocities.
- 2) Subsequent periods included Diamond Pipe formation. See Chapter 10 - Kinetic Pipes, which liberated sufficient energy to launch projectiles into orbit, and deposited diamondiferous material near Earth's surface.
- 3) Currently, volcanic chambers with roots deeper than 80km have sufficient energy to launch orbiting satellites.

## 8 *SOLAR ROTATION*

A proto planet probably does not have any significant component of solar (axial) rotation as it condensed from an orbiting dust cloud in gravitational lock with the Sun. The direction of rotation throughout the Solar System is usually the same as the sidereal motion (prograde). This strongly suggests the mechanism for initiating solar rotation is a common phenomenon.

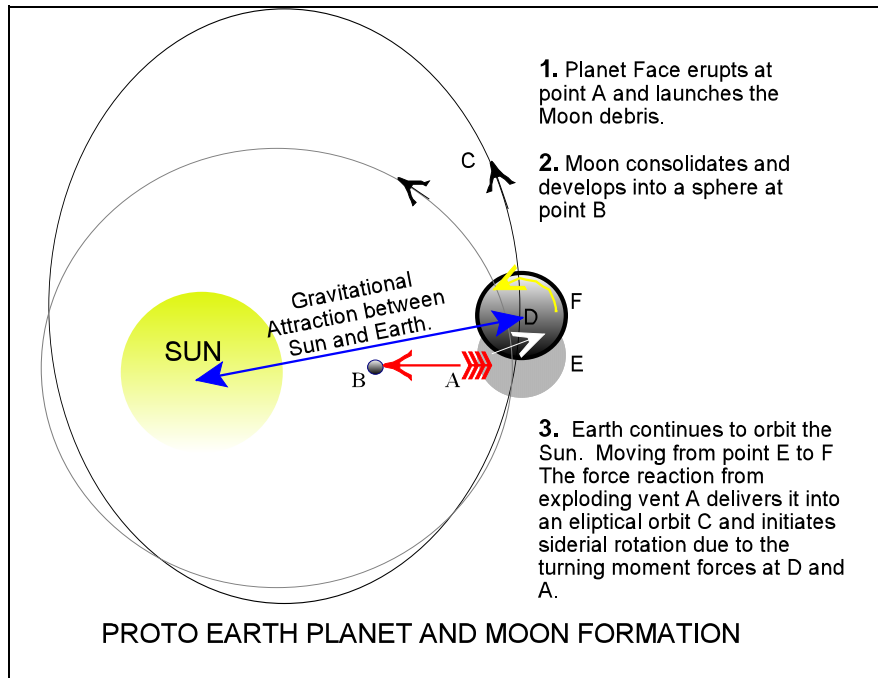


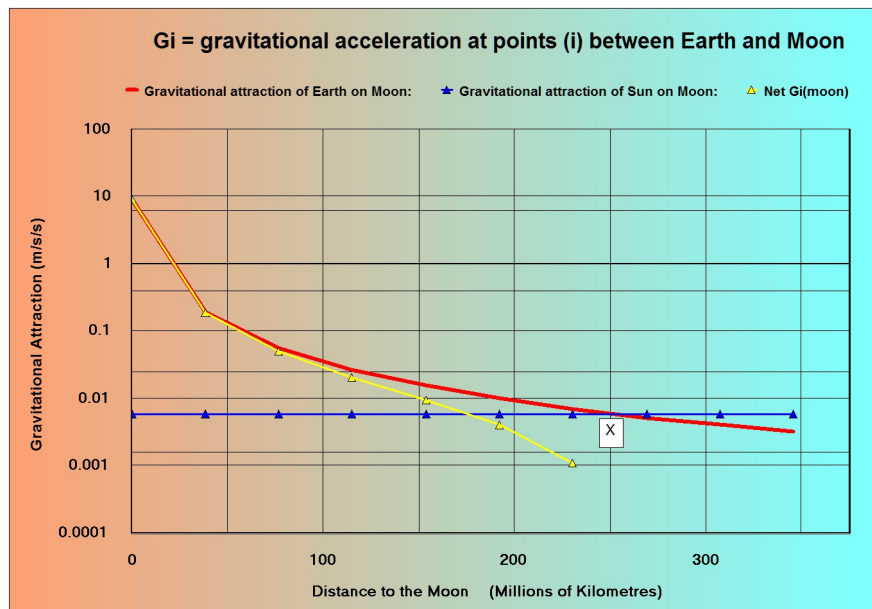
Figure 8.1 – Common Solar and Satellite Rotation Initiation: Earth - Moon example

At the point of initial eruption, the gas jet force reacts on the surface of the planet as shown in Figure 8.1. Simultaneously, the sidereal orbit of the planet moves the centre of centrifugal attraction (planet's centre-of-gravity) ahead of the jet force action. This establishes a turning force couple comprising the jet stream reaction with the centrifugal force. Turning forces cause planets to accelerate on their axes, developing solar angular velocity, or axial rotation. The reaction to the jet stream force also causes the planet to move into an elliptical orbit around the Sun.

Uneven, or very weak heating at the planet surface, causes an asymmetric gas-discharge from the planet. This can produce a variety of orbit directions and inclinations in both the parent planet and ejected satellites. Possible examples include Uranus, Triton, Nereid, Pluto and Charon where the Sun's influence is much weaker.

Venus had strong surface heating due to its proximity to the Sun, and this resulted in premature diffusion of pent-up gas pressure, before any satellites could launch.

The Earth – Moon system can be checked for discharge velocity and angular momentum:



Graph 8.1 – Gravitational Variation from Earth Towards the Sun

### 8.1 MOON'S DISCHARGE DISTANCE

Earth has slowed since the initial spin sequence. The Moon's orbit has also moved further away from Earth.

The gravitation variation between the Earth and Sun shown in Graph 8.1 gives some clue as to the maximum distance the Moon could have traveled after its initial launch (Point X), before it would have been captured by the Sun's gravity.

If the Moon traveled further than 250,000 km from Earth in the direction of the Sun, it would have gone into a solar orbit. See Paragraph 8.3 However, this did not occur so the distance traveled by the Moon is limited to a maximum of 250,000 km.

Least squares combination of the net  $G(i)$  positions shows this curve is represented by:

$$g(i) = 6.777 - 0.357 \times \ln(Di) \quad (8.1)$$

Where,  $g(i)$  is net gravitational attraction at points ( $Di$ ) between Earth and Moon.

The mean gravitational attraction can be found by integrating this expression between the limits of 250,000 km and zero,

$$\left( \int_{0\text{km}}^{250\text{ km}} 6.777 - 0.357 \times \ln(Di) \partial Di \right) \div 250\text{km} \quad (8.2)$$

$$([6.777 \times Di - 0.357 \times Di \times (\ln(Di)-1)]^{250\text{km}}_{0\text{km}}) \div 250\text{ km}$$

$$G(\text{mean}) = \frac{[0.1\text{E}-1 \{6.777-0.357(\ln(0.1\text{E}-1)-1)-250\text{E}6(6.777-0.357(\ln(250\text{E}6)-1))\}]}{250\text{E}6} = -0.231\text{m/s} \quad (8.3)$$

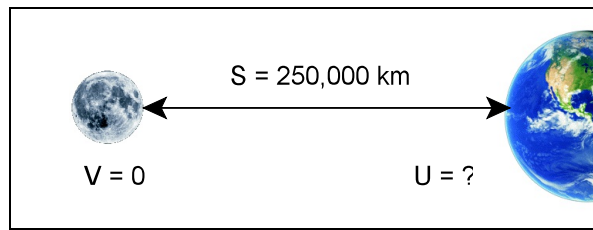


Figure 8.2 – Moon Earth Initial Separation

## 8.2 MOON'S DISCHARGE VELOCITY

Assume the Moon ejected directly towards the Sun. As the Moon left Earth, the Earth's gravitational pull grew weaker and the Sun's grew stronger. The mean deceleration (8.3) was  $0.231 \text{ m/sec}^2$ .

The maximum discharge velocity was therefore:

$$\text{Given } V^2 = U^2 + 2gS$$

$$\text{when } V = 0, U = (-2 \times -0.231 \times 250E6)^{1/2}$$

$$U = 10.75 \text{ km/sec} \quad (8.5)$$

## 8.3 LUNAR ORBIT

This velocity (8.5) had no tangential component to the planet, and could have resulted in the Moon crashing back to Earth. By the time the Moon returned to the Earth's previous location – under Earth's gravitational influence, the Earth had accelerated into a faster and higher ellipsoid, sidereal path discussed in Figure 8.3. This impetus was due to the escaping volatile jet. The Moon therefore missed hitting the Earth, and passed behind its orbit. This initiated the Moon's posigrade rotation around Earth that has continued ever since.

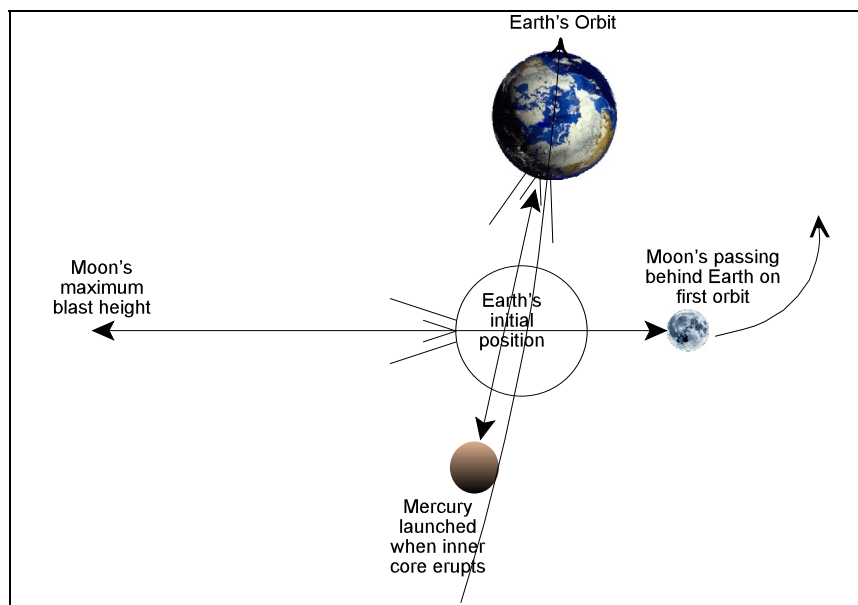


Figure 8.3 – Moon returns to pass below Earth's location and Mercury launches into lower solar orbit

Mercury launched as shown in Figure 8.3 and further discussed in Paragraph 14.1

#### 8.4 SOLAR ROTATION

Coral-core records<sup>26</sup> suggest there were 410 days per year in the Paleozoic (230-620 million years ago). This implies the Earth initially (4.5 B.y.) spun at speeds somewhere between 690 and 1,931 days per year.

Let's assume the speed was 800 days per year (4.03E-6 radians/second). The Earth picked up solar rotation and increased sidereal momentum during the surface discharge of the internal volatiles.

Also,

$$\text{Mass of the Earth (M)} = 5.9764\text{E}+24 \text{ kg}$$

$$\text{Mass of the Moon (m)} = 7.3500\text{E}+22 \text{ kg}$$

$$\text{Mean radius of the Earth (r)} = 6,378,000 \text{ m}$$

The estimated solar angular velocity ( $\omega$ ) initially present was therefore,

$$800 \times 360 \div 57.3 \div 365.25 \div 24 \div 60 \div 60 = 1.593\text{E}-4 \text{ radians per second} \quad (8.6)$$

The planet energy contained in this angular velocity is given by  $\frac{1}{2}I\omega^2$ , where  $I = M^2/5 r^2$

$$\text{Energy} = \frac{1}{5}M(r\omega)^2 = \frac{1}{5} \times 5.976\text{E}+24 \times (6.378\text{E}+6 \times 1.593\text{E}-4)^2 = 1.234\text{E}+30 \text{ joules} \quad (8.7)$$

The energy imparted to the Moon during its launch was equal and opposite to that imparted to the Earth (after Newton):

$$\begin{aligned} \frac{1}{2}mU^2 &= \frac{1}{2} \times 7.23\text{E}+22 \times (10.74\text{E}+3)^2 \\ &= \mathbf{4.17\text{E}+24 \text{ Mj}} \end{aligned} \quad (8.8)$$

Therefore the energy provided to the Earth by the 'catherine wheel' effect, after the Moon launched was,

$$1.234\text{E}+30 - 4.17\text{E}+24 = \mathbf{1.234\text{E}+30 \text{ Mj}} \quad (8.9)$$

Thus, the vast majority of the angular momentum present in the Earth during Archean times, developed from the escaping volatiles reacting against the centrifugal force of the Sun. This is evident, because result (8.9) is much larger than (8.8).

#### 8.5 ENERGY CHECK

To check the availability of this quantity of energy, consider the Earth has a cold compact exterior shell. Internal heating and segregation starts from within. See Figure 3.1 While the core settles away from the light volatile material and heating continues, pressure builds in the volatiles as discussed in Section 7 – Escape Velocity. In this example the chamber of heating volatiles is considered to be continuous rather than in discrete pockets of energy postulated in Chapter 7. The temperature profile develops as estimated for Archean times some 200°C to 1,000°C, depending on depth, and higher than at present. See Graph 7.3 - Archean Temperature Gradients on Earth.

The heat energy associated with this temperature profile was found by incrementing the Earth's cover depth by 250 km increments and allocating a specific heat range for each increment. These ranged from 0.50 for shallow depths to 0.60 at the centre, as shown in Table 8.1

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<sup>26</sup> *Science Digest*, Critters, Dec.1988)

EARTH'S Total Energy Pool When Heat Flux EXCEEDS Steam Point Temperatures								
Radius of Earth	m	6,378,000						
	Inc	250,000						
Cover Depth ( m)	m	0	250,000	500,000	750,000	1,000,000	1,250,000	1,500,000
Density @ Depth ( set 1m=2.2)	2.2	1.73	4.43	4.63	4.75	4.84	4.91	4.97
Mean Density @ Depth	p	1.96	2.79	3.25	3.55	3.76	3.93	4.06
Pressure @ Depth	psi	14.97847	987942.4	2303267	3775462	5339780	6965432	8635489
Steam Point Temperature	T ( oC)	95	2,101	2,661	3,054	3,365	3,624	3,848
Earth's Archean Temperature at Depth	T ( oC)	0	2,323	2,960	3,411	3,767	4,065	4,323
Temperatures ( Deg. C)	T ( oC)	0	222	300	356	402	441	475
Specific Heat Variation @ Depth	SpHt	0.50	0.50	0.51	0.51	0.52	0.52	0.52
Superheat Energy	CHU	0	111.9485	152.1375	182.2665	207.2266	228.9702	248.5049
Heat Energy @ Depth	j/kg	0	468907.9	637243.6	763442.4	867990.2	959065.6	1040889
Incremental Globe Volume	m^3	5.1E+013	1.2E+020	1.1E+020	1E+020	9.5E+019	8.7E+019	7.9E+019
Incremental Globe Mass of Water	kg	5.1E+013	1.2E+020	1.1E+020	1E+020	9.5E+019	8.7E+019	7.9E+019
Incremental Heat Energy	joules	0	5.8E+025	7.2E+025	7.9E+025	8.3E+025	8.3E+025	8.2E+025
Incremental Heat Energy ( formula)	j	-2E+026	6E+025	7.1E+025	7.8E+025	8.2E+025	8.9E+025	8.4E+025
Total Planet Heat @ Depth ( by integration) 250-262km	joules	2.4E+030						
Total Planet Heat @ Depth ( by integration) 1250-1500k	joules	0						
Total Planet Heat to 1500km	joules	2.4E+030						
Earth's Archean Angular Energy	1/2Iw^2	1.2E+030	51%					

Table 8.1 – Excess Heat Flux

Heat energy at each depth increment is equal to:

$$\partial T \times \partial SH \times \partial mw \times 1.8011 \div 430E6 \text{ j/kg} \quad -8.1$$

Where  $\partial T$  is the temperature range above steam point,  $\partial SH$  is the specific heat at depth,  $\partial mw$  is water mass equivalent at the depth increment, and  $1.801 \div 430E6$  converts CHU to j/kg.

These points were combined by least squares and found, for depths ( $D_i$ ) greater than 250km and less than 1,250km, to represent:

$$-1.418E26 + 1.623E25 \times \ln(D_i) \quad -8.11$$

and for depths greater than 1250km:

$$1.128E26 - 1.895E19 \times (D_i) \quad -8.12$$

The total energy available at depth is given by the integration:

$$\int_{250\text{km}}^{1250\text{km}} 1.418E26 + 1.623E25 \times \ln(D_i) \partial D_i + \int_{1250\text{km}}^{6000\text{km}} 1.128E+26 - 1.895E19 \times D_i \partial D_i \quad -8.13$$

$$\left[ -1.418E26 \times D + 1.623E25 \times \ln(D_i) \partial D_i - 1 \right]_{250\text{km}}^{1250\text{km}} + \left[ 1.128E26 \times D - 1.895E19 \times D^2 \div 2 \right]_{1250\text{km}}^{6000\text{km}} \quad -8.14$$

Accumulating heat quantities to only 262km depth gives:

$$2.43E+30 + 0 = 2.43E+30 \text{ joules} \quad -8.15$$

The planet's energy, contained in angular momentum from equation (8.7), represents 51% of this figure. It shows there was sufficient energy available in a 12km depth of crustal material, to initiate Earth's angular momentum, which also allows for some efficiency losses. The 12km depth figure seems reasonable given that most volatile materials eventually condensed to form seas and atmosphere, broadly equivalent to this consolidated depth.

## 8.6 PLANET RINGS

Such a violent discharge of material produces many small projectiles besides the satellite body. Some fragments of crust and cooled magma, also orbit the planet. Over time the orbits decay, showering the planet surface with a rain of meteorites. The Eye Stage ring structures are likely to be dark coloured, similar to the Asteroid belt, and rings at Uranus.

## 8.7 SATELLITES AND WATER

The escaping steam jet cools adiabatically and can form into satellites with some rock fragments. These can produce low density satellites commonly orbiting some of the outer Solar System planets.

- ☐ The presence of water shows residual steam condensed during the satellite launch stage and attaches to the projectile.
- ☐ Alternatively, it suggests that satellites ejected in association with a mass of preexisting condensates.

This is consistent with satellites launched after an initial eruption fractured the surface and released some superheated gases that cooled adiabatically. Subsequent eruptions occur when inner planet shells successively rupture in response to reducing outside pressures, and force the projectiles through the condensate column.

Our Moon shows little evidence of water (there is a recently discovered ice lake at the south pole) suggesting that it launched from Earth ahead of an issuing steam jet, or together with some volatiles contained in the mare regions. Mars, on the other hand, retains an atmosphere and frozen poles including ice and carbon dioxide, as well as two small satellites. This suggests that it launched in association with condensates from a massive Jupiter system blast.

## Chapter 8. Interim Conclusions

- 1) The Moon's surface represents how the Earth surface was before the internal volatiles burst through the outer shell.
- 2) Solar rotation and elliptical sidereal rotation were provided to the Earth during the Moon launch.
- 3) Mercury launched from the Earth into a sidereal orbit shortly after the Moon launch at speed in excess of the escape velocity between 11.18 and 18.25 km/sec.

9  
*GIANT PLANET CLOUD CONDENSING*

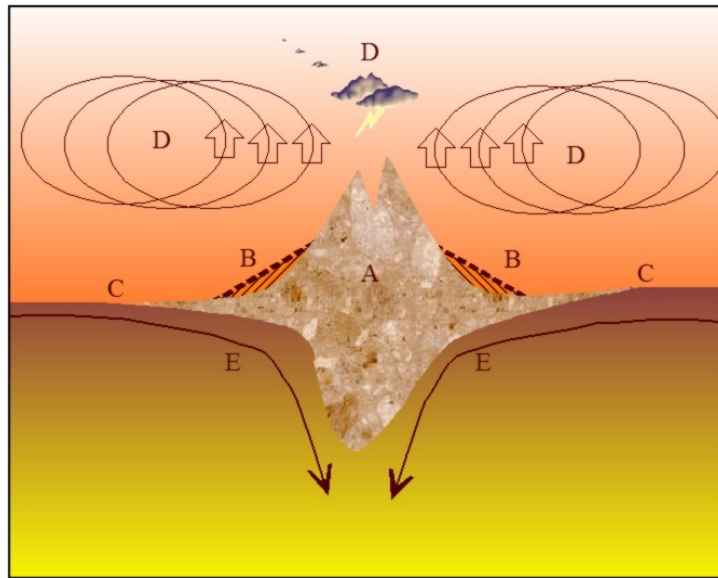


Figure 9.1 – Protocontinent with Rain and Massive Sedimentation

Circa -3500my, Figure 9.1 shows radial compressive forces, created by globally circulating magma “E”, built up thick highly folded, greenstone rocks. A dumbbell shaped Proto Continent “A” resulted from stronger equatorial magma currents.

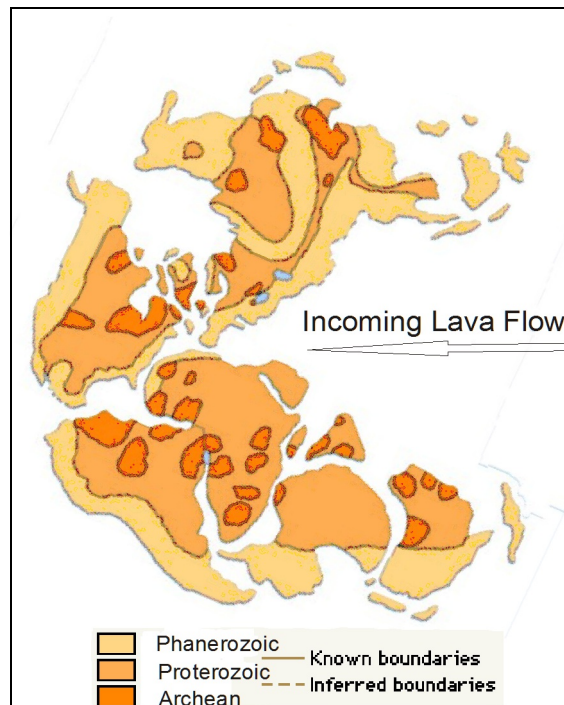


Figure 9.2 - Precambrian Supercontinent

Figure 9.2<sup>27</sup>

<sup>27</sup> [www.britannica.com/EBchecked/topic/474302/Precambrian-time](http://www.britannica.com/EBchecked/topic/474302/Precambrian-time)



and<sup>28</sup>

*Distribution of Archean crust shown on a paleomagnetic reconstruction of a Precambrian supercontinent.*

Figure 9.1 shows how granite condensed under the mass forming a ridge of older (high-grade) greenstone over Landmass “A” reached 100 km into the giant planet’s CO<sub>2</sub> & SO<sub>2</sub> rich atmosphere, (10-15 times Mt Everest). Ridge sides sloped at 40° over a base width of 250 km. The high atmospheric density ensured that steep mountain slopes remained stable.

This alpine structure provided a unique path for condensing fluids from the cold upper atmosphere to travel rapidly back to the molten surface at “C”. The lopsided land mass may impart a processing component to the planet’s solar rotation.

Without a high mountain range, the insulating properties of giant cloud mass layers remain intact. A hot sterile world, similar to that on Venus results.

Massive erosion forces occurred, including glaciation and weathering, with the condensation-evaporation cycle (Figure 9.1 - “D”) creating thick sequences of conglomerate beds at (Figure 9.1 - “B”). Some of these remain on Earth today in the Precambrian Witwatersrand system in South Africa, and at Telfer in Western Australia.

In this era, the average surface temperature on Earth was 650°C, well above that for sustaining current surface life forms. However, colder temperatures existed in the highland lakes associated with the condensation cycle, and anaerobic life started to develop. This period of evolution may be present on Neptune, and somewhat less probably on Uranus today.

The Proto Continental stage of activity on Earth spanned 0.7 billion years from -3500my to -2800my. During this time water and Si-rich planet rings formed through pipe activity and later decayed. The Moon became tectonically inactive as the meager supplies of nuclear fuel ran out.

Earth’s giant planet phase ended as the cloud mass condensed to form lakes. Major sedimentation occurred, and the molten surface cooled rapidly. Permanent seas quickly followed crustal coast extension. The Proto Continent broke up and reassembled six times before forming the Pangaea land mass. The rest [sic] ‘is geological history’.

The future is for continued cooling, reducing humidity, followed by frozen seas in about 50+ my time. See Chapter 22 Global Cooling Rate.

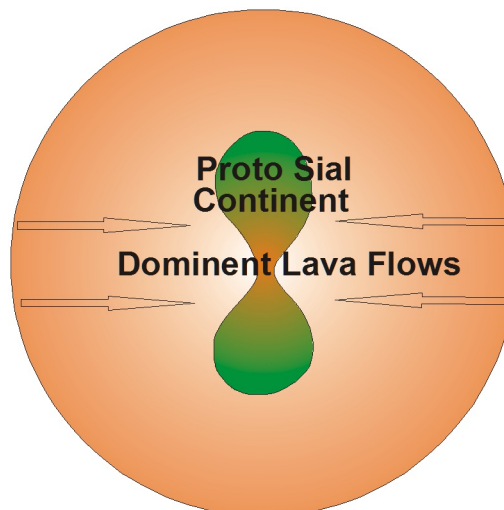


Figure 9.3 – Protocontinent Plan View

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<sup>28</sup> Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. p375.

### **Chapter 9. Interim Conclusions**

- 1) A Protocontinent develops through elutriation of lava flowing from the Eye to the opposite side of the globe where a Vortex forms.
- 2) Condensation of the giant cloud only occurs when a high landmass develops above the Vortex site.

### 10.1 DYNAMIC MECHANISMS

This treatise proposes a sinkhole, drawn into the underlying plastic rock material by downward convecting, whirlpooling, magma flows. This can form a Kinetic Pipe - further discussed at Figure 10.1 and Paragraph 10.3. The depression below the overlying crustal or sedimentary rocks becomes geotechnically unstable. Brittle overlying rocks collapse into the void, forming 'mass cave' structures. The void continues to sink and fill with collapsed roof, runoff and ground water, carbonaceous material (new or old), and wall rock. Water pressure and detritus effectively support the steep sided walls as the pipe draws ever deeper. Depth increases to where temperature and pressure are sufficient to convert carbon into diamond. This column of material becomes superheated and is very unstable. Any mechanism that causes the column to rise, results in the release of ever increasing amounts of energy. The release of energy only stops after the vent ejects the majority of superheated material. Two possible mechanisms could cause column instability:

- a) A long period of hot climate following a relatively cool period will cause the upper levels of the vent to heat, expand, overflow, and reduce in density. This lowers the pressure on the column and initiates converting potential energy into kinetic energy. This mechanism may explain the periodically noted violent rising storms in the northern cloud patterns on Saturn. These have followed extended periods with the northern hemisphere pointing towards the Sun.<sup>29</sup>

*Just what the GWS (Great White Spot) is not fully understood. Saturn's normally 'calm' appearance is now considered to be the result of a high layer of aerosols (small solid particles) and haze (liquid drops) obscuring the lower atmosphere. The five large spots observed during the past 200 years have occurred with puzzling regularity – in 1876, 1903, 1933, 1960 and 1990. This coincides with the time of mid-summer in Saturn's northern hemisphere.*

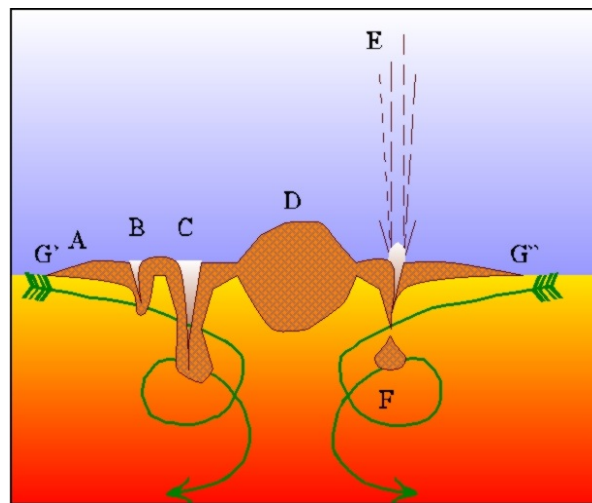


Figure 10.1 - Vortex with Protocontinent and Pipe Blowing

- b) When the convecting magma vortex eventually breaks off the underlying crustal blobs, see Figure 10.1 - "F", or its vortex action diminishes; an isostatic adjustment occurs. It allows the crustal layers over a localised area to float back to a higher elevation. The reduced pressure on the superheated volatiles filling the pipe, causes a massive and gathering release of energy. See Figure 10.1 - "E".

<sup>29</sup> Geoff McNamara, *Southern Astronomy*, Planetary Page 52, Jan/Feb 1991: quote

A violent ejection of the pipe contents occurs when superheated steam (geyser), jets detritus high into the atmosphere. Entrained rock fragments massively shear to the point where they form a characteristic kimberlite, or similar material. Wall rocks tear from the pipe wall, and may come to rest at a higher elevation, or eject completely from the vent. Diamond bearing material, if present, can return to a higher elevation, or exit the pipe completely, and exceed planet escape velocity. This could deliver diamondiferous rocks into space, which eventually return as meteorites.<sup>30</sup>

*A meteorite that fell to Earth in 2008 is giving scientists and miners more evidence of the vast amount of riches that celestial bodies may hold.*

*According to a new study to be published in the August edition of the *Geochimica et Cosmochimica Acta* journal, several fragments of the Almahata Sitta, the first meteorite ever identified and tracked before it hit our planet, contained diamonds far larger than any yet seen in any of those celestial bodies.*

*Not only that. Masaaki Miyahara of Hiroshima University in Japan and his colleagues believe such diamonds formed in a planet that existed when our solar system was forming, and that has shattered since. In their paper, the scientists explain that some of the recovered diamonds are broken, with their separate crystals all oriented correspondingly, which suggests that some of those tiny gems used to be part of a larger one.*

The vent ejection pressure can be sufficient to form radiating dyke structures away from the vent. Subsequent weathering will produce the various known diamondiferous deposits.

At the time of ejection, Si-rich projectiles may form orbiting rings around the planet. Alternatively they may return to the surface as showers of tektites immediately, or subsequently. Earth's rotation probably deposited sub orbital tektites, to the Archean west of the origin pipe vent. However, weathering most probably removed all trace of the material except erosion resistant diamonds, and associated harder minerals. Deeper pipe material may suffer magma contamination and have a higher iron content, forming stony-iron meteorites. These may orbit for some time before planet capture occurs.

## 10.2 KIMBERLITE DEPOSITS

Pipe and dyke structures on Earth appear as kimberlites in every continent. They are all located on Precambrian shield belts (but penetrate some younger sequences), and are unique in that no similar vents have developed recently. They apparently formed under tectonic conditions not currently existing on Earth. Diamond deposits show that carbon existed in Kinetic Pipes at around 200 km depth, where the pressure and temperature are sufficient to form diamonds. Carbon may be drawn from the surface into the sinkhole structures or injected igneously into the column during the down casting cycle.

Diamond pipes are graphically described<sup>31</sup> as;

*... vertical, carrot-shaped bodies of ultrabasic rock with diameters up to 2,300 feet (701 m) and depths of 3500 feet (1067 m). The kimberlite contains many inclusions of overlying and underlying rocks.... The pipes decrease in size with depth and the diamond content diminishes.... The astonishing rock inclusions packed in the South African pipes are of particular interest. Some of them containing fossils are the only evidence of a former cover of Karoo beds. According to Williams, some inclusions in the pipes now lie 2,500 feet (762 m) below their source and these include fragile fossiliferous shales that could not have sunk in such a heavy magma. Masses of igneous rocks have been lifted 2,700 feet (823 m); one 500 foot (10 Mt) block of granite has been raised 244 feet (74 m).... the diamonds crystallized in the original magma chamber and were carried up as crystals in kimberlite magma to the present site of cooling. - One astonishing bit of evidence supports this view – two broken parts of a rodlike diamond crystal were found at different levels of the De Beers mine and when placed together they fitted exactly. This diamond obviously had crystallized before reaching its present site.*

This evidence shows material has both risen and sunk within the pipe, but it is not definitive about the sequence that occurred. The quoted text concludes;

*that a first stage was gas explosion following which masses and fragments fell back into the cavity. Then came a slow upwelling of kimberlite magma that floated up blocks from below and slowly closed around the dropped-in fragments but was not hot enough to affect them.*

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<sup>30</sup> <http://www.mining.com/meteorites-heading-to-earth-may-contain-trillions-of-diamonds/>

<sup>31</sup> Bateman, *Economic Mineral Deposits*, 2nd.Ed. Wiley, 1959. pp.838-839

Liquid magma showing no effect on rock fragments (including fossils) is difficult to imagine.

### 10.3 KINETIC PIPE GENESIS

Surface meltdown existed on Earth for the first 700 million years (4550my to 3800my), before a proto continent started to form. Magma elutriation processes occurred, as with other Super Critical Mass planets which lets lighter silica, aluminium, and magnesium rich materials to form a scum on the molten surface. See Section 5 – Critical Planet Mass. Lava scum collects near the Vortex. See Figure 1.4 As temperatures reduce, the raft becomes more permanent.

Figure 10.1 shows radial compressive forces ( $G''$  &  $G'$ ) from the incoming magma, building a thick highly folded, continental core (D). A plastic raft of thinner material surrounds the thick core. Downwards flowing magma forms vortices under the plastic raft and progressively entrains some underlying surface, creating pendants (A-B-C). While the pendants grow longer a central void forms (similar to glass blowing), and 'Block Caving' occurs in the overlying brittle rocks. The central void fills with liquid, mud, and boulders. This creates a viscous hot mixture with little convective flow. The fluid mass heats and reaches high confining pressures as the depth of burial increases. Eventually a plastic blob (F) pulls away from the underside, and an isostatic release of the overlying layer occurs. The high temperature brew suddenly reacts, at lesser burial depths, to much lower confining pressures. It forms into superheated steam. Rock and fluid contents explosively eject (E) into the atmosphere, and sometimes tear the surface to form dyke structures radiating from the vent. Rock fragments become highly sheared due to their exploding moisture contents and the kinetic release of energy.

Quiescent vents on Earth today are kimberlite/lamproite pipes as shown in Figure 10.2. Diamond formation, associated with the pipes, required burial depths around 200 km where pressures reach 100,000 atmospheres. The superheated steam released in Archean times, when lifting material from 200 km below the surface, was sufficient to accelerate particles above Earth's escape velocity of 11.2 km/sec. See Section 7 – Escape Velocity.

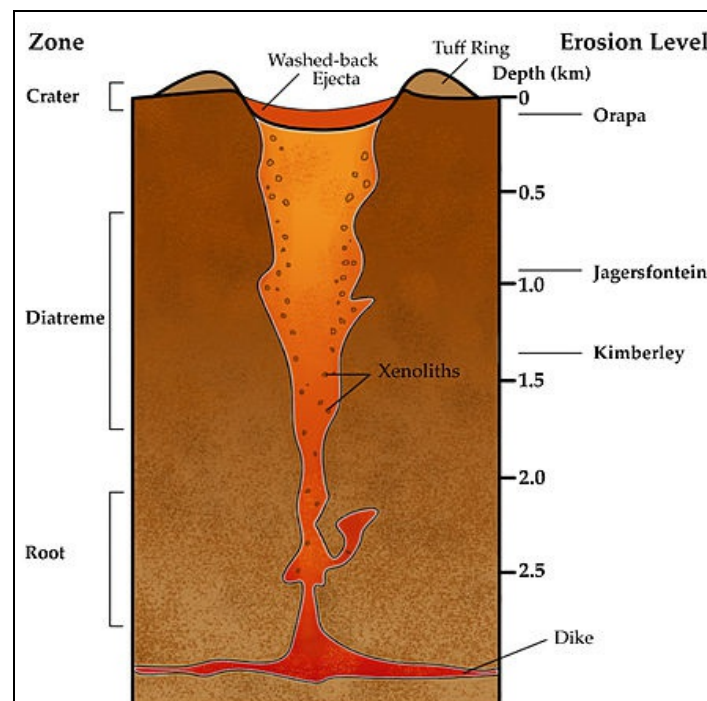


Figure 10.2 - Diamond Pipe Section<sup>32</sup>

### 10.4 COMETS

Comets may have a Kinetic Pipe or Eye vent origin. Violent cloud disturbances associated with pipe activity are periodically visible in the Saturn atmosphere, as referenced in Paragraph 10.1a. This may signify that new comets

<sup>32</sup> [https://en.wikipedia.org/wiki/Volcanic\\_pipe](https://en.wikipedia.org/wiki/Volcanic_pipe)

launch today in parts of the Solar System, but their trajectories suggest an Oort Cloud origin. See Paragraph 21.2 For comets to form, ejection velocities must exceed the planet's escape velocity. Saturn's is 35.6 km/sec, and Jupiter's is 59.6 km/s.

At launch speeds greater than escape velocity, projectiles can adopt parabolic orbits around the Sun. See Chapter 7 – Escape Velocity, and Paragraph 21.2. This is consistent with some comet trajectories.

**Chapter 10. Interim Conclusions:**

- 1) Much of the ejected material from Kinetic Pipes can reach and exceed planet orbiting speeds.
- 2) Silica rich meteorites originate from Kinetic Pipe activity, while iron rich asteroids are more likely to come from Eye spot vents.
- 3) Kinetic Pipe material forms the classic ice and rock ring structures surrounding Saturn, and is possibly the origin for some low density smaller satellites. Ice and/or rock rings are present, to a waning extent at other outer giant planets. This implies that ejection mechanisms have universal application with planets of Super Critical Mass. The Vortex stage of activity on Earth peaked over one billion years from -3500my to -2550my. Kinetic Pipe activity continued much longer, but at a considerably reduced level.

## 11 ICE AGES

The part that Ice Ages play is relevant to climate change. In Canada the 850m wide retreating Athabasca Glacier, is evident. So too are the truncated remains of the Crows Foot Glacier – with comparative photo at the lookout point (circa 1920) showing the full set of talons. Similarly, several other glaciers in both hemispheres are retreating.

One can stand in awe viewing the 325km Columbia Icefield that feeds the Canadian rivers of ice. The Jasper National Park brochure on the area reports,

*The most recent ice age ended only 10,000 years ago. Most glaciers in North America are still in retreat, as the summer's melt is greater than the winter's accumulation.*

and then

*Man's accelerating use of fossil fuels, destruction of the planet's forests and release of industrial gases like chlorofluorocarbons, are causing a global warming trend, commonly called the Greenhouse Effect. This phenomenon is hastening rates of the glacier's retreat and the icefield's loss of volume.*

'Greenhouse Effect', aka 'Global Warming' aka, 'Climate Change' is a widespread topical discussion. This statement of man's traumatic effect on nature subordinates the first 9,500 years of evidence, and mixes the ozone hole supposition up with 'greenhouse effect'. The logic suggests that global warming caused by industrial gas emissions (mostly carbon dioxide - CO<sub>2</sub>), reduce the winter's accumulation of snow through melting and therefore the feedstock to the glaciers. It seems more probable that pervasive global warming would heat the seas, lift the rate of evaporation, increase the snow fall in the icefields, and **extend** the glaciers.



Figure 11.1 - Amalia Glacier in retreat as it once filled the whole valley in the Patagonian Icefield

Recent work by Professor Nasif S. Nahle, "Observations on "Backradiation" during Nighttime and Daytime" concludes:<sup>33</sup>

*Through a series of real time measurements of thermal radiation from the atmosphere and surface materials during nighttime and daytime, I demonstrate that warming backradiation emitted from Earth's atmosphere back toward the earth's surface and the idea that a cooler system can warm a warmer system are unphysical concepts.*

Unsurprisingly, this finding accords with the Second Law of Thermodynamics.

Evidence apparent in retreating glaciers is the result of less global humidity. (Also shown by the expanding Sahara and other deserts.) Icefields defrost in much the same way as the icebox in an old refrigerator defrosts with the power turned off. The 'power supply' for glaciers is hot sea water. Hot seas arise mainly through spreading mid ocean ridges and other submarine tectonic events. A more detailed discussion of sea changes and the concentration of atmospheric carbon dioxide, consistent with Henry's Gas Law, is available<sup>34</sup> and<sup>35</sup>.

### 11.1 THERMAL INTRODUCTION

A critical release of core heat to the sea in recent geological times, is along the Mid Atlantic Ridge. Ocean-floor topographic data shows mid ocean ridges sit between parallel pairs of mountain ranges, and extend to around 65,000km. Each ridge represents a period when the sea floor expands and large volumes of magma exude, thereby heating the sea. The intervening valleys represent a period of reduced lava emission and slower spreading, resulting

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<sup>33</sup> Nasif S. Nahle, University Professor; Scientific Research Director at Biology Cabinet, Monterrey, MX

<sup>34</sup> [www.bosmin.com/SeaChange.pdf](http://www.bosmin.com/SeaChange.pdf) - RA Beatty

<sup>35</sup> [http://icecap.us/images/uploads/Focus\\_0808\\_endersbee.pdf](http://icecap.us/images/uploads/Focus_0808_endersbee.pdf) - Emeritus Professor Lance Endersbee..



in less sea heating. Venting submarine lava leads to higher sea temperatures that affect weather patterns, and higher concentration of carbon dioxide in the atmosphere.<sup>36</sup>

Deep sea temperatures depend on which combination of mid ocean ridges or subduction zones are currently active, while sea surface temperatures are influenced by surface wind patterns as well as rising plumes of hot sea water. Rainfall is influenced by where the ocean currents are carrying the heated water, and what effect this has on the prevailing wind moisture content. The system is very random and complicated, and therefore unlikely to ever be accurately predicted, or modeled.

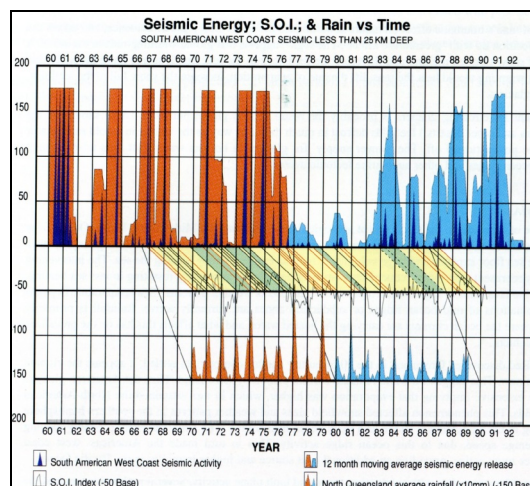
When Eric-the-Red discovered Greenland in the 10th century and his compatriots settled, the climate in Greenland was milder than now. This suggests a warm Atlantic current surrounded Greenland. Then the American glaciers were also more extensive implying that evaporation was higher, which in turn sustained the North American mountain icefields. This phenomenon affected snowfield sizes and weather patterns in the southern hemisphere as well, pointing to the Mid Atlantic Ridge as a significant ocean heat source. The Americas were probably drifting west at above average speed, due to MAR activity. This in turn made the Americas' west coast subduction zones more active, providing an additional heat source and higher humidity in the Pacific Ocean.

There is a close relationship between sun spot activity and global weather conditions. It currently appears that Earth is entering another period of low solar activity, which has been associated with extended periods of colder weather. How deep or how long these periods might extend, is unknown.

## 11.2 WEATHER PATTERN EFFECTS

While macro weather effects such as Ice Ages possibly relate to macro tectonic events it seems micro weather patterns can relate to micro-tectonic events. Lava and fault-line energy released on the ocean floor results in pools of heated sea water ascending to the surface, and increases atmospheric humidity in localised areas.

Preliminary work on this theory by the author, compared seismic energy released at depths less than 25 km along the South American west coast with Queensland rainfall. Energy released between 1960 and 1992 was graphed against Southern Oscillation Index (S.O.I.) and rainfall in North Queensland from 1970 to 1991. An aim of this work was to see if the Humboldt and Mentor currents circulating anti-clockwise in the South Pacific ocean were bringing hot sea water to the east coast of Australia, and influencing the rainfall. Humboldt and Mentor currents move at rates less than 1.5 kmph, and the warmer water may take about three years to reach Australia. Graph 11.1 shows a broad correlation to this effect for the decade 1967-1977, with elevated rainfall occurring three years offset during 1970-1980.



Graph 11.1 - Rainfall and Seismic Correlation<sup>37</sup>

<sup>36</sup> [www.bosmin.com/HenrysLaw.pdf](http://www.bosmin.com/HenrysLaw.pdf) - RA Beatty

<sup>37</sup> Author - July 2011.



More recent publications have added meat to the bones of this discussion. In particular results collected from the ARGO buoy distribution. John Reid, May 3rd 2014 published in Quadrant *Ocean Vents And Faulty Climate Models*.<sup>38</sup>

*It hardly needs to be said that climate modelling is a far-from-settled science, despite what its practitioners would have us believe. Just how flawed becomes even more apparent when you consider that massive heat sources on the ocean floor have been entirely omitted from the warmists' calculations*

And from Subaqueous volcanism: ocean vents and faulty climate models Anthony Watts / May 4, 2014<sup>39</sup>

*I have updated that post with this animation showing a heat plume disconnected from the ENSO pattern and Google Earth graphic showing possible subaqueous volcanism sources*

#### **Chapter 11. Interim Conclusions:**

- 1) Widespread earthquake activity signals renewed plate movement, core heat release, warmer seas, higher levels of atmospheric carbon dioxide, increased humidity, more rainfall, a buildup of snow on the world's icefields, and advancing glaciers.
- 2) The long term trend, beyond solar variations, is for reduced global geothermal activity. Periods of lower humidity will increase with time, and Ice Ages, as we know them will become less frequent.
- 3) Ice forming on a cooling planet is low energy ice and forms at sea level as opposed to high energy ice evident in mountain top glaciers.

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<sup>38</sup> <https://quadrant.org.au/opinion/doomed-planet/2014/05/ocean-vents-faulty-models/>

<sup>39</sup> <https://wattsupwiththat.com/2014/05/04/subaqueous-volcanism-ocean-vents-and-faulty-climate-models/>

## *DYNAMIC GEOLOGICAL TIME SCALE*

The current broad geological time scale identifies the following Eras,<sup>40</sup> in ascending order:-

Period (My)		Interval (My)	Eras	
-4550	-3000	1550	Precambrian	– Katarchean
-3000	-2500	500	``	– (Late) Archean
-2500	-650	1850	``	– Proterozoic
-650	-280	370	Paleozoic	
-280	-63	217	Mesozoic	
-63	-0	63	Cenozoic	

Table 12.1 – Geological Time Scale

Major dynamic events occurred during this time scale.<sup>41</sup> These are included with the current treatise logic to broadly define the following Dynamic Stages:-

In Summary:-

PERIOD	(My)	INTERVAL(My)	DYNAMIC STAGES
-4550	-4400	150	ACCRETION
-4400	-3800	600	EYE
-3800	-3500	300	VORTEX
-3500	-3400	100	SOLIDUS
-3400	-3300	200	PROJECTILE
-3300	-2800	500	TERRAFIRMA
-2800	-2550	250	OCCLUSION
-2550	-1900	650	DECOMPOSE
-1900	-700	1200	ADHESION
-700	+50	750	DRIFT
+50	+400	350	SEDATE
+400			HIBERNATE

Table 12.2 – Summarised Dynamic Stages

Early geological events known to have occurred on Earth show a remarkable parallel to events which appear to be happening on other Solar System planets. See Chapter 22 - RAB Diagrams.

<sup>40</sup> References: Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. p1; G.J.H McCall, *The Archean – Searching for the Beginning*, Dowden, Hutchinson & Ross Inc. Penn, USA, 1977.p373; John Waldman, *Geology Made Simple*, Rev. Ed, Made Simple Books Doubleday & Coy Inc, New York, 1982. p137

<sup>41</sup> References: Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. pp365-377; David Lambert, *The Cambridge Guide to the Earth*, Cambridge University Press, 1988. p184.

Time (My)	Dynamic Stage	Event
-4550	<b>ACCRETION</b>	<b>Solidification of proto-earth</b> Solar & nuclear heating Rapidly rising planet temperature
-4400	<b>EYE</b>	<b>Moon/Earth separation</b> Up welling lava activity on Moon Formation of Fe-rich planet rings Molten Earth surface Strong Eye activity Giant planet phase
-3800	<b>VORTEX</b>	<b>Decay of Fe-rich planet rings</b> End of intense cratering period Proto Continental formation begins with small short-lived islands of crustal float positioned over the turbulent Vortex.
-3500	<b>SOLIDUS</b>	<b>Start of stable greenstone formations</b> Primitive anaerobic life forms. Minor cloud condensation
-3400	<b>PROJECTILE</b>	<b>Start of kinetic pipe activity</b> Formation of Si-rich planet rings
-3300	<b>TERRAFIRMA</b>	<b>Dominant greenstone formation with granite understorey</b> Igneous placement - Cu,Ni,Fe,Au&Cr Basin settling with igneous infill
-3200	.....	Moon becomes tectonically inactive
-2900	.....	Massive cloud condensation Major sedimentation period Rapid magma cooling & crustal coast extension
-2800	<b>OCCLUSION</b>	<b>End of giant planet phase</b>
-2700	.....	Climax formation of Proto Continent Convection current
-2600	.....	direction reverses below the Protocontinent.
-2550	<b>DECOMPOSE</b>	<b>Proto Continent uplift and more rapid erosion</b>
-2300	.....	The Proto Continent splits into several sub Continents.
-2000	.....	Extensive shallow seas form. Free oxygen accumulating at sea
-1900	<b>ADHESION</b>	<b>Start of second Continent stage (Wopmay Orogeny, Canada)</b> Supercontinent - one land mass
-1200	.....	Start of third Continent stage Extensive shallow seas form
-700	<b>DRIFT</b>	<b>Start of fourth Continent stage</b>
-600	.....	Soft bodied marine animals flourish Separate Continents: North America, Europe, Asia: a, b & c, and Gondwanaland.
-500	.....	End kinetic pipe activity
-430	.....	Ice age - g
-400	.....	Ice age - q
-400	.....	North America-Europe-Asia: a rejoin, Asia: b & c, Gondwanaland, Tethys Sea formed.
-285	.....	Ice age - b
-280	.....	All Continents combined into Pangaea with Tethys Sea.
-170	.....	Eurasia, North & South America, Antarctica/Australia, Africa, India, Tethys Sea gone.
-60	.....	Eurasia/India, North & South America, Antarctic, Australia, Africa.
-15	.....	Ice age – a

Table 12.3 – Detailed Dynamic Time Scale for Earth

## **Chapter 12. Interim Conclusions**

- 1) Many of early Earth geological periods appear to be associated with particular dynamic phases that lasted through eras, before being replaced with new sets of dynamics.
- 2) Early geological events known to have occurred on Earth show a remarkable parallel to events which appear to be happening on other Solar System planets.
- 3) The time displacements of events between Earth and other Solar System planets appears to relate to the differences in planet mass.

13  
*SOLAR SYSTEM PLANETS*

Some generally accepted parameters concerning Solar System bodies are summarised below:

**\*\* Retrograde orbits. Escape Velocity Tabulation.**<sup>42</sup>

SYSTEM	MAJOR		ESCAPE	ORBIT	SOLAR	AXIS	SIDEREAL	ORBIT	SEMIMAJOR	ECCENT.	MASS (kg)	SG
	SATELLITES		SPEED	SPEED	ROTATION	INCLIN.	ROTATION	INCLIN.	AXIS		1.00E+020	
		#	kps	kps	(Days)	(o)	(Days)	(o)	m		kg	
SUN											2.00E+030	
MERCURY		0	4.25	47.4	58.7	<28	88.00	7	5.79E+010	0.206	3.03000e+23	5.43
VENUS**		0	10.36	35	-243	3.00	224.70	3.4	1.08E+011	0.007	4.90E+024	5.2
EARTH		1	11.19	29.8	1	23.45	365.26	0	1.50E+011	0.017	5.98E+024	5.5
	MOON	-			27.3		-	5.15	3.84E+008		7.35E+022	3.34
MARS		2	5.02	24.1	1.029	25.19	687.00	1.9	2.28E+011	0.093	6.42000e+23	3.93
	PHOBOS	-			0		-		9.40E+006		1.00E+016	2.2
	DEIMOS	-			0		-		2.35E+007		2.00E+015	1.7
ASTEROIDS	CERES	-			0		-		4.14E+011	0.077		
	VESTA	-			0		-					
	PALLAS	-			0		-					
	JUNO	-			0		-					
	EROS	-			0		-					
JUPITER		67	59.54	13.1	0.412	3.08	4,332	1.3	7.78E+011	0.048	1.90E+027	1.3
	AMALTHEA	-			0		-		1.81E+008			
	IO	-			0		-		4.22E+008		8.94E+022	3.5
	EUROPA	-			0		-		6.71E+008		4.80E+022	3.3
	GANYMEDE	-			0		-		1.07E+009		1.48E+023	1.9
	CALLISTO	-			0		-		1.88E+009		1.08E+023	1.8
	LEDA	-			0		-	26-28	1.11E+010	0.11-0.21		
	HIMALIA	-			0		-	26-28	1.15E+010	0.11-0.21		
	ELARA	-			0		-	26-28	1.17E+010	0.11-0.21		
	LYSITHEA	-			0		-	26-28	1.17E+010	0.11-0.21		
	PASOPHAEE **	-			0		-	17-33	2.35E+010	0.17-0.41		
	SINOPE **	-			0		-	17-33	2.37E+010	0.17-0.41		
	CARME **	-			0		-	17-33	2.26E+010	0.17-0.41		
	ANANKE **	-			0		-	17-33	2.12E+010	0.17-0.41		
	AURORAE											
SATURN		62	35.49	9.7	0.426	26.73	10,761	2.5	1.43E+012	0.056	5.64E+026	0.7
	JANUS	-			0		-	0-2.0	1.51E+008			
	MIMAS	-			0		-	0-2.0	1.86E+008		4.00E+019	1.2
	ENCELADUS	-			0		-	0-2.0	2.38E+008		8.00E+019	1.2
	TETHYS	-			0		-	0-2.0	2.95E+008		7.50E+020	1.3
	DIONE	-			0		-	0-2.0	3.77E+008		1.10E+021	1.4
	RHEA	-			0		-	0-2.0	5.27E+008		2.50E+021	1.3
	TITAN	-			0		-		1.22E+009		1.35E+023	1.9
	HYPERION	-			0		-		1.48E+009			
	LAPETUS	-			0		-	15	3.56E+009		1.90E+021	1.2
	PHOEBE **	-			0		-	30	1.30E+010			
URANUS**		27	21.29	6.8	-0.45	82.08	30,685	0.8	2.87E+012	0.046	8.73E+025	1.3
	MIRANDA	-			0		-		1.30E+008		8.00E+019	1.3
	ARIEL	-			0		-		1.91E+008		1.30E+021	1.6
	UMBRIEL	-			0		-		2.66E+008		1.30E+021	1.4
	TITANIA	-			0		-		4.36E+008		3.50E+021	1.6
	OBERON	-			0		-		5.83E+008		2.90E+021	1.5
NEPTUNE		14	23.71	5.4	0.4	28.80	60,195	1.8	4.50E+012	0.010	1.03E+026	1.7
	TRITON **	-			0		-	20.00	3.54E+008		1.49E+022	2.07
	NEREID	-			0		-	28.00	5.52E+008			
PLUTO**		5	1.27	4.7	0.4	112.00	90,475	17.2	5.91E+012	0.248	1.49E+022	1.86
	CHARON **	-			0		-		1.97E+007		3.74E+021	2

Table 13.1 – Solar Systems Bodies

<sup>42</sup> [http://www.windows2universe.org/our\\_solar\\_system/planets\\_table.html](http://www.windows2universe.org/our_solar_system/planets_table.html)

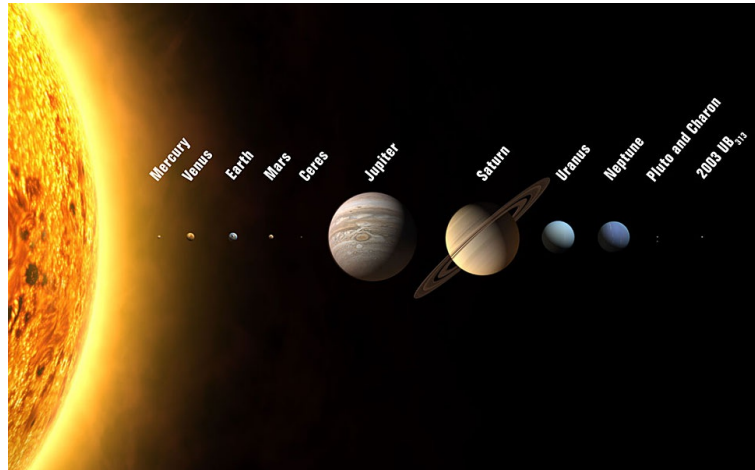


Figure 13.1 - Planets of the Solar System<sup>43</sup>

The following discussion considers the four ‘rocky’ inner and other outer Solar System planets separately, with images courtesy of NASA. The distribution is more graphically displayed in Figure 13.2

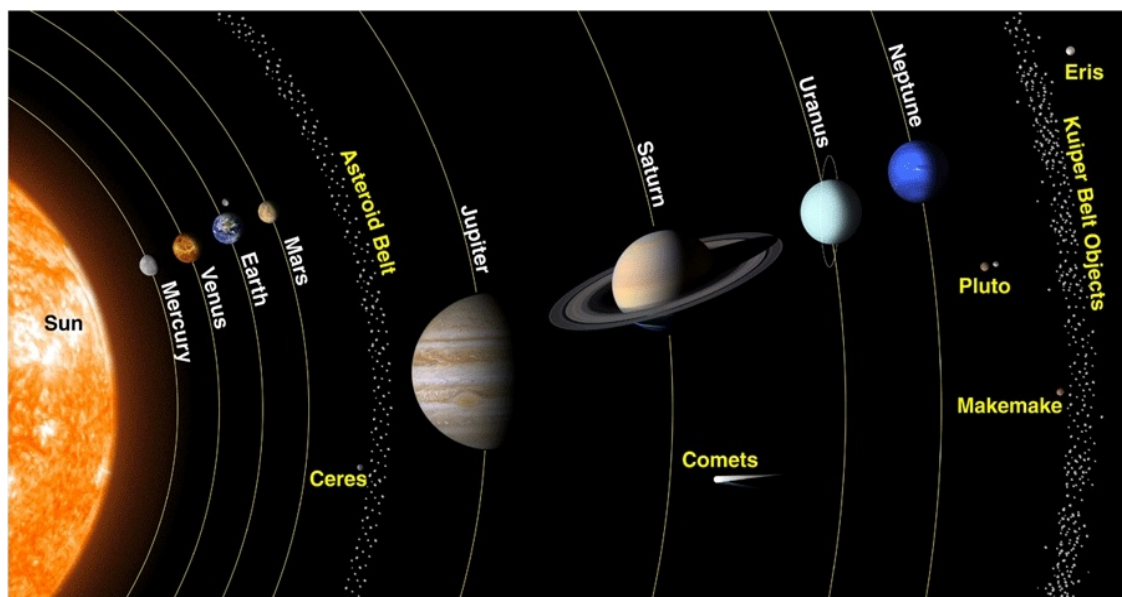
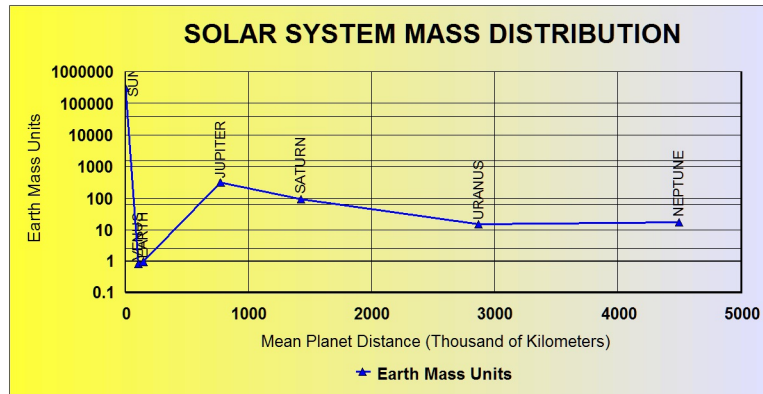


Figure 13.2 - Inner and Outer Solar System Planets

This treatise suggests which Dynamic Periods may currently be associated with those planets at or near the Super Critical Mass size. See Chapter 5 – Critical Planet Mass.

Some orbiting bodies are less than, or close to Critical Mass. Venus appears to fit this situation with mass of 0.82 Earth Mass Units (EMU). An orbiting body with a Super Critical Mass appears to be at, or larger than Earth size. However, even the larger bodies may abort or imperfectly function through the Eye Stage if their distance from the Sun results in only weak surface heating.

<sup>43</sup> <http://www.universetoday.com/15878/diagram-of-the-solar-system/>



Graph 13.1 - Sun and Six Proto Planet Mass Distribution

Mass distribution across the Solar System is lense like if we consider Mercury, Mars, Asteroids, Pluto and the Kuiper Belt objects as post planet formation bodies. The mass distribution across the Solar System forms into a regular distribution as shown in Graph 13.1 – Sun and Six Proto Planet Mass Distribution, which might prove more plausible than the now abandoned Titus-Bode Law relationships.<sup>44</sup>

### Chapter 13. Interim Conclusion

- 1) Planets Venus, Earth, Jupiter, Saturn, Uranus, and Neptune appear to be six original solar orbiting bodies, while other Solar System objects have subsequently evolved as orbiting objects.

<sup>44</sup> [https://en.wikipedia.org/wiki/Titus%E2%80%93Bode\\_law](https://en.wikipedia.org/wiki/Titus%E2%80%93Bode_law)

### 14.1 MERCURY

*With a mean radius of 2440 km and a mass of  $3.3022 \times 10^{23}$  kg, Mercury is the smallest planet in our Solar System – equivalent in size to 0.38 Earths.<sup>45</sup>*

It is therefore of Sub Critical Mass. In assuming this is a true planet we overlook the possibility of Mercury being a captured body ejected during Eye activity from either Earth, Saturn or Jupiter. See Paragraph 8.3

At first inspection this possibility appears remote, due to the planet's relatively high density compared to other moons. However, Mercury's unusually close association with the Sun and small size probably combined to remove the low density components. Mercury also has a large iron core suggesting it might have originated from a deep-seated rupture of a large planet inner core. Under these circumstances a higher density for Mercury is quite feasible. Mercury originating from Jupiter, just after Mars' launch, as discussed at Paragraph 8.3 is one possibility. It also has an inclined elliptical orbit similar to Pluto's that suggests capture or modification after the dust cloud contracting stage.



Figure 14.1 - The Mercury Dual Imaging System (MDIS) on the MESSENGER spacecraft - NASA

As one of the four terrestrial planets of the Solar System, a number of inferences can be made about its internal structure. For example, geologists estimate that Mercury's core occupies about 42% of its volume, compared to Earth's 17%.

*The interior is believed to be composed of a molten iron which is surrounded by a 500 – 700 km mantle of silicate material. At the outermost layer is Mercury's crust, which is believed to be 100 – 300 km thick. Mercury's core has a higher iron content than that of any other major planet in the Solar System. Despite its small size and slow 59-day-long rotation, Mercury has a significant, and apparently global, magnetic field that is about 1.1% the strength of Earth's. It is likely that this magnetic field is generated by a dynamo effect, in a manner similar to the magnetic field of Earth. This dynamo effect would result from the circulation of the planet's iron-rich liquid core.*

As a true 'planet', Mercury is the closest to the Sun and experiences the greatest surface heating. This strains the surface rocks to a greater depth than any other planet, and reduces the possibility of an explosive release of internal volatiles at the protoplanet stage. It is probable that the initial radioactivity within the planet caused a slow buildup of pressure that easily dissipated through the porous outer surface. This mechanism precludes the formation of satellites and limits the possibility of axial rotation from gas ejection. The current planet heat is mostly due to radiant heat from the Sun. Mercury has a very elliptical orbit that processes about the Sun. The planet exhibits an unusual mechanical solar rotation reported to be three solar orbits for two sidereal orbits. Mercury's rotation was analysed by Albert Einstein, and found to be in magnetic lock with the Sun, due to their proximity.

Earth is the strongest contender as the parent planet for Mercury. Surface similarities with the Moon are apparent. The large iron core and close solar orbit suggest a late launch from Earth after solar rotation had just started, but at a speed slightly greater than Earth's escape velocity of 11.19 mps, but discounted by Earth's sidereal velocity of 29.78 mps. This means Mercury entered a solar orbit at a minimum speed of 18.59 mps. At this velocity, it would have stabilised into a solar orbit at an average distance of 93,000 km<sup>3</sup> from the Sun. Mercury currently keeps an average distance of 57,900 km<sup>3</sup> which means its orbit has decayed since launch, or the launch speed from Earth was nearer to 18.25 mps. The latter launch speed would have delivered Mercury into its existing solar orbit.

<sup>45</sup> <http://www.universetoday.com/13943/mercury/>



*The existence of water ice and even organic molecules has been confirmed on Mercury's surface. The floors of deep craters at the poles are never exposed to direct sunlight, and temperatures there remain below the planetary average.*

Recent discovery of pole water may derive from residual traces of ejection volatiles.

## 14.2 VENUS

Venus has no satellites (or significant axial rotation), but there is evidence of substantial heating activity. Earth's 'sister planet' is slightly smaller than the Earth at 0.82 EMU.

<sup>46</sup>*Venus has more volcanoes than Earth, and has 167 large volcanoes that are over 100 km across. It has been theorized that the lightning is being caused by a volcanic eruption. Other evidence is the periodic rise and fall of sulfur dioxide concentrations in the atmosphere, which could be the result of periodic, large volcanic eruptions. And finally, localized infrared hot spots (likely to be in the range of 800 – 1100 K) have appeared on the surface, which could represent lava freshly released by volcanic eruptions.*

Large clouds of volatiles (96.5% CO<sub>2</sub>, some SO<sub>2</sub> and N<sub>2</sub>) surrounding the planet show that a volatile release stage has occurred. Any projectiles associated with this release had insufficient velocity to orbit the planet and fell back to the surface immediately with significant impact (Artemis Chasma?). Gravity forces are strong enough to retain the atmosphere at a fairly dense level, although it appears much hydrogen has vented to space.<sup>47</sup>



Figure 14.2 - Venus

Solar rotation at Venus is -243 days and compares with a sidereal rotation of 224.7 days.<sup>48</sup> This suggests the planet is effectively in close to tidal lock with the Sun. An absence of satellites also shows the volatile ejection phase was diffuse and probably occurred over a wide area on the planet surface. A lack of eccentricity in the elliptic orbit (max 109Mkm min 107.4Mkm) and a lack of orbiting satellites supports this contention. The orbit of Venus is probably the most typical Archean orbit present in the Solar System today and suggests how other true planets used to circle the Sun.

It appears that the planet went through the Accretion Stage. See Table 12.2 – Summarised Dynamic Stages. Venus produced a diffuse series of volatile fountains. These failed to confer any significant solar angular momentum or elliptical strain. The proximity of the Sun may have resulted in deep surface softening that produced docile pressure release. The absence of a ring system confirms the lack of tectonic brisance. Volcanic lava flows have occurred as confirmed by the presence of basaltic rocks, initially photographed during the Russian space craft mission. One possibility is that these flows came from a series of vents situated near the equatorial region. See Chapter 4 – Weightless Convection Currents.

It is unlikely that the surface ever completely melted down. Pioneer Venus radar altimeter records show a +12km high mountain and a -1.5km valley at 180° opposite sides of the planet, but both situated 65° north. This provides some evidence to support Eye and Vortex formation. See Figure 1.2. Here the Eye is more likely to be the highland area, because there was insufficient magma heat to build any more than a conventional volcanic vent (Cleopatra). There is a parallel with Olympus Mons on Mars. The low area on Venus may be a vortex hole where lava returned to the core. The highland (whether formed by Eye or Vortex activity) is about seven times too low to allow effective

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<sup>46</sup> <http://www.universetoday.com/14069/venus/>

<sup>47</sup> after Thomas Donahue University of Michigan

<sup>48</sup> I.F. Clark & B.J. Cook. *Geological Science – Perspectives of the Earth*, Tien War Press, Singapore, 1986, p27

condensate cooling, and the gas cloud remains intact. The low land is too far north to suggest a general surface melt down ever occurred on Venus.

If the low land and high land are associated activities, it is likely they represent a surface meltdown restricted to the northern hemisphere only. Further evidence for this comes from the southern mountain region of Aphrodite where non volcanic igneous rock was found by the VEGA missions in 1985.

A low crater count on Venus is cited as evidence for a younger planet surface, but the dense atmosphere has significantly defused impact forces. However as Venus seems never to have launched orbiting projectiles, there may not be the potential for 'self induced' meteor impacts observed at places like the Moon.

Continuing presence of a huge cloud of volatiles suggests that no effective condensing path established between the cold upper cloud formations and the hot lava surface. For this to occur, it is necessary for a high Proto Continent to form. This acts as a condensation point and a cool river path to the hot lava surface layers. Lava heat then evaporates the condensate and takes up latent heat. This rapidly convects to the upper atmosphere, where the resident heat efficiently radiates into space. See Chapter 9 – Giant Planet Cloud Condensing. An absence of a high proto continent and virtual lack of solar rotation are probably the most important factors leading to the vastly different environments on Venus and Earth. However, the thin crust and magma lake activities probably provide a good example of how the Moon (near side) and Mars mare areas developed before those surfaces cooled.

### 14.3 EARTH AND MOON

Planet Earth seems close to the bottom end of the Critical Planet Mass, and was far enough away from the Sun to prevent premature softening of the outer proto-surface. Planet size was sufficient to sustain internal heating through surface meltdown, and great enough to form the high Proto Continent crucial to initiating giant cloud condensation. A subsequent rapid conduction of heat into the high altitudes provided a unique opportunity for surface heat dispersion. This process happened quickly enough to limit the quantity of hydrogen lost to space through the dissociation of atmospheric water molecules. Without this condensation path, conditions on Earth would be similar to those on Venus.

The Moon separated from Earth in a single event about 4,550M years ago. Distance measurements show the Moon (apogee) is still slowly retreating from the Earth due to tidal drag – at an average rate of six cm/year. This statistic probably says more about where the Moon came from, than where it is going. The start of the Eye Stage also produced Fe-rich rings of debris that circled in an equatorial orbit around both Earth and Moon. The debris progressively returned to Earth and Moon surfaces as major meteorites during the following 750M years. A period of lava lake (mare) formation persisted on the Moon, before reduced fission activity produced the solid, mostly inert surface apparent today.



Figure 14.3 Earth

Earth continued through a complicated series of land forming and other processes summarised elsewhere. See: Section 12 – Dynamic Geological Time Scale. It is not possible to predict the future development path for the Earth by observing any other Super Critical Mass (SCM) planet, because Earth has the lowest SCM, and is therefore the coldest of these planets. However some inferences may be drawn for larger SCM planets still cooling along the established Earth temperature profile.

No other significant heat source can replace diminishing fission activity on Earth. It is therefore possible to extrapolate the rate of cooling to a point where the surface of the Earth is effectively at freezing temperature. Calculations show this will occur in about 410My time. See Section 14 – Global Cooling Rate. At this point the seas will turn to ice, and drifting sand will soon cover them up. Moisture and other gases removed from the atmosphere by condensation and freezing will ensure that final cooling occurs at an accelerated rate.

One proviso applies to this statement. Recent work associated with the formation of mass on Earth associated with

gravity may indicate the accumulation of extra mass on Earth described as Gravimass.<sup>49</sup> The extra mass could include new radioactive material which would slow the rate of cooling.

The Moon is discussed elsewhere:

Chapter 6 – Moon Rocks

Chapter 7 – Escape Velocity, and

Chapter 8 – Solar Rotation.

#### **Chapter 14. Interim Conclusions**

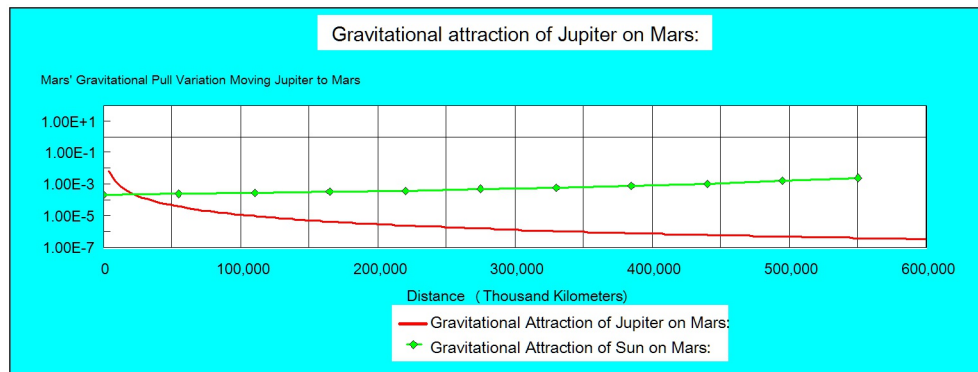
- 1) This treatise concludes that the most plausible origin for Mercury is a late launch from Earth immediately following the Moon launch, at a velocity of up to 18.25 mps.
- 2) Venus is too close to the Sun and of insufficient mass to form a normal planet and moon system. The result is Venus is in near tidal lock with the Sun, and similar to the original proto cloud sidereal orbit.
- 3) Earth was just above Sub Critical Size and far enough from the Sun to prevent premature release of satellite launch volatiles. The result is a planet further advanced along the Dynamic Stages of Development, than any other of the Solar System planets. Currently, Earth is in the Drift Stage.

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<sup>49</sup> [www.bosmin.com/PSL/GRAVIMASS.pdf](http://www.bosmin.com/PSL/GRAVIMASS.pdf) - RA Beatty

### 15.1 MARS

Mars is an unusual planet in that it has noticeably less mass (0.11 EMU) than planets Earth & Jupiter on either side of its orbit. The mass deficiency uniquely excludes this planet from the general lenticular mass distribution, sometimes postulated to have existed in the Solar System's proto gas cloud (Titus-Bode Law). Mars has a density of 3.93 placing it with a group of bodies: Moon 3.34, Io 3.5, Europa 3.3, and Triton 4. The later three are all satellites and Mars may also be considered in this light. Mars orbits inside the great asteroid belt, separating it from the orbit of the Solar System's largest planet and orbiting energy source, Jupiter (317.9 EMU).



Graph 15.1 - Sun/Jupiter Gravitational Fields

The great size of Jupiter suggests the Eye Stage was extremely fierce. This liberated sufficient energy to place satellite Mars beyond the Jovian gravitational sphere of influence, and into orbit around the Sun. The orbit stabilised due to residual sidereal rotation transferred from Jupiter. Gravitational variation between the Sun and Jupiter illustrated in Graph 15.1, shows Mars projected at least 25 million kilometres away, to where the two gravitational fields cross.

A relatively high eccentricity for Mars (0.093) further suggests satellite capture by the Sun, rather than an orbiting dust cloud origin. The intervening Asteroid Belt illustrated in Figure 15.1, suggests this solar ring ejected from Jupiter simultaneously with Mars, rather than the more commonly observed planet rings.

The asteroid belt, which is 186 million kilometres further out from Mars, ejected from Jupiter at the same time, and must have reached at least to the 25 million kilometres solar orbiting distance from Jupiter, as per Graph 15.1. Therefore, the minimum Mars to Jupiter separation was 211 million kilometres.

Jupiter is currently 550 million kilometres from the Mars orbit indicating that Jupiter accelerated to a higher solar orbit during its Eye Stage development, by up to 349 million kilometres.

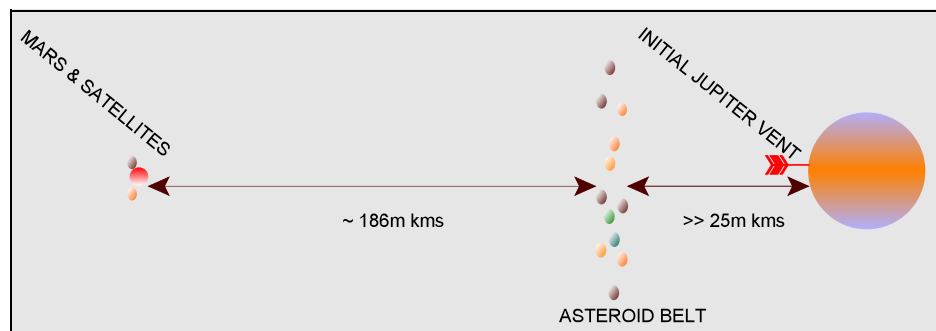


Figure 15.1 – Mars Launch from Jupiter - Stage 1

The Asteroid Belt provides evidence of a remaining Fe-rich eruptive jet stream. Two Martian satellites Phobos and

Deimos ejected from Jupiter with Mars as asteroid sized particles during the Jovian Eye Stage. Deimos and Phobos are objects too small to form spherical collapse profiles, as are the Asteroids, and probably cooled very rapidly under adiabatic conditions following their ejection from Jupiter.

Mars maybe the outermost Jupiter satellite, but this ignores the possibility that Kuiper Belt objects could also have a Jupiter origin. See Chapter 21.

Subsequent tectonic activity on Mars is more accurately compared with a satellite such as the Moon, although Mars is much larger and cooled more slowly than the Moon. Initially a hot Martian proto-sphere ejected large quantities of magma that formed extensive lava seas.

Information from the Viking missions show the southern surface consist of ancient cratered terrain and the northern area has younger volcanic plains remaining substantially intact.<sup>50</sup> Tongues of the ancient southern surface encroach into the northern hemisphere.<sup>51</sup> The ancient surface may present a relic of the Archean Jupiter surface – albeit modified by oxidation and hydration events, following the separation of the two bodies.

The ancient surface is probably lower density than the magmatic portion and consequently floats at a higher elevation than the northern province. A tectonically active, northern hemisphere has an interesting similarity with that reported at Venus.



Figure 15.2 Mars



Figure 15.3 Martian Moons

The cratering history on Mars suggests several more asteroids previously orbited Mars. Their orbits progressively decayed until only Phobos and Deimos remain. Olympus Mons, the large shield volcanic feature in the northern hemisphere, with 30 km of relief represents the most significant vent on Mars. It is associated with other volcanic mounts, Arsia Mons and Pavonis Mons. Lava vents confirm significant previous igneous activity, but were insufficient to cause general surface meltdown. This puts Mars below CPM as discussed in Chapter 5 - Critical Planet Mass.

Part of the ejecting volatile stream from Jupiter also stayed with Mars to form an atmosphere.<sup>52</sup>

*Although liquid water cannot exist on Mars' surface, owing to its thin atmosphere, large concentrations of ice water exist within the polar ice caps.*

Originally the ejecting volatiles formed a gas cloud probably composed of water vapour and carbon dioxide. Subsequently a condensate path developed to the surface, possibly via Olympus Mons. The polar ice caps are reportedly water ice in the north and dry ice in the south. This supports a northern hemisphere water condensation cycle, leaving the carbon dioxide to colonise the southern polar regions. Rapid surface cooling followed gas cloud condensation, and currently equatorial surface temperatures range from 33°C to - 143°C. Widespread permafrost is likely reaching from the equatorial regions.

*As a terrestrial planet, Mars is rich in minerals containing silicon and oxygen, metals, and other elements that typically make up rocky planets. The soil is slightly alkaline and contains elements such as magnesium, sodium, potassium, and chlorine. Experiments performed on soil samples also show that it has a basic pH of 7.7*

Mars' size enabled a small atmosphere to remain composed of 96% carbon dioxide, 1.93% argon and 1.89% nitrogen along with traces of oxygen and water. This resulted in a previous condensation phase showing typical erosion

<sup>50</sup> Abell, Morrison, Wolff, *Exploration of the Universe*, CBS College Pub. 1987, p298

<sup>51</sup> Patrick Moore, *The Astronomy Encyclopaedia*, RD Press, 1987, p244

<sup>52</sup> <http://www.universetoday.com/14701/mars/>



patterns in mid northern latitudes.<sup>53</sup> Recent imagery shows flow patterns still active at some steep wall locations.

The development sequence for Mars appears to be;

- 1) Ejection from Jupiter into the Sun's gravitational field with the solar component of rotation associated with that explosive discharge.
- 2) Migration into a solar orbit due to a reduced residual component of the Jovian sidereal momentum.
- 3) Collapse into spherical shape with northern hemisphere general meltdown and southern hemisphere remaining solid, or plastic.
- 4) Rapid surface and core cooling with localised volcanic activity persisting from residual radioactivity.
- 5) Lava cones grow very large aided by a lack of plate movement, and a comparatively low force of gravity and weathering regime.
- 6) Gas cloud condensation cycle predominantly restricted to the northern hemisphere where a high land peak and low surrounding terrain attract, store, and evaporate condensate. Bedded sediments remain.
- 7) Regression of volcanic activity, frozen volatiles, and formation of extensive surface dust.

## 15.2 ASTEROID BELT

<sup>54</sup> The term "trojan" originally referred to the "trojan asteroids" (Jupiter trojans) that orbit close to the Lagrangian points of Jupiter.

The Jupiter trojans in front of and behind the planet along its orbital path, the asteroid belt between Mars and Jupiter, and the Hilda asteroids. See Figure 15.4 Jupiter trojans Asteroid belt Hilda asteroids

This treatise suggests the Asteroid belt probably represents vent spray, ejected from Jupiter with the existing three Martian bodies as illustrated in Figure 15.1 All now orbit beyond the Jovian direct sphere of gravitational influence. The magma spray cooled rapidly through radiation after its release from Jupiter (similar to volcanic bombs). This explanation is consistent with the irregular asteroid shapes. Irregular shapes are unlikely to occur if the objects came from agglomeration of smaller particles or from dust. The larger proto particle sizes have prevented accretion through gravitational attraction. This has resulted in separate jockeying for orbit position, and results in an orbiting belt of separate bodies.

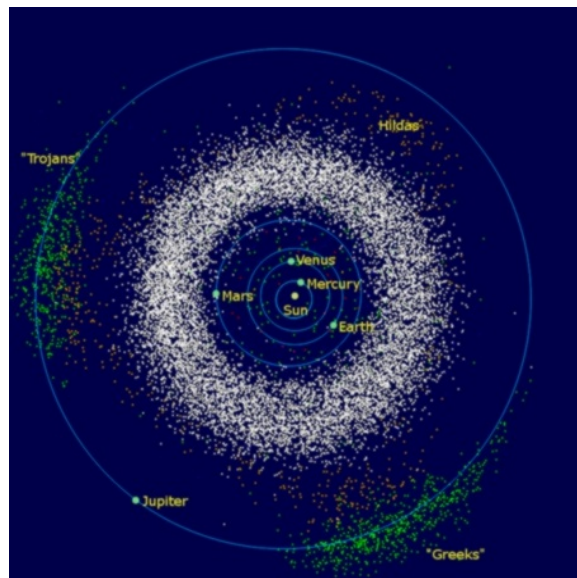


Figure 15.4 - Jupiter trojans Asteroid belt, Hilda asteroids

A source of the Asteroids has been postulated, as resulting from the disintegration of a single body – possibly due to major impact. This explanation is difficult to reconcile, because a single spherical body would probably have a molten centre. This is unlikely to disintegrate and separate for a sufficiently long period to allow particle distribution around a complete solar orbit. In the latter case a recombination of both incoming and host bodies seems more likely, as commonly occurs with other orbiting bodies.

Total mass of the asteroid belt is less than that of the Moon.<sup>55</sup> This supports the objects being of ejectile origin rather than from the disintegration of a completely separate and unrelated planet.

<sup>53</sup> David Baker, *Astronomy*, Country Life Books, 6th Imp, The Hamlyn Pub, 1986. p184

<sup>54</sup> [https://en.wikipedia.org/wiki/Trojan\\_\(astronomy\)](https://en.wikipedia.org/wiki/Trojan_(astronomy))

<sup>55</sup> I.F. Clark & B.J. Cook. *Geological Science – Perspectives of the Earth*, Tien Wah Press, Singapore, 1986, p34

### **Chapter 15. Interim Conclusions**

- 1) Both Mars and the Asteroid Belt could have launched from Jupiter in a violent eruption during the early Eye Stage of the planet development.
- 2) The great mass of Jupiter may be expected to completely dominate early eruption activity in the Solar System.

## 16 JUPITER

This treatise suggests the well known ‘red eye’ is the top of the planet’s volcanic Eye Stage activity associated with highly active core magma flows. Jupiter is exhibiting strong Eye activity and probably is still in the Mid Eye Stage (equivalent to 4By ago on Earth). Jupiter emits heat, but significantly less on a proportion basis than Saturn.

### <sup>56</sup>*Heat emission of Jupiter and Saturn*

*It is known that Jupiter's internal heat emission can be accounted for by a progressive change of solid hydrogen from its molecular to metallic form at rate of about 1 mm per year. (Nature, 215, 691, 1967). It turns out that the same rate of phase change agrees with the observed rate of heat emission from Saturn (2.7 and 2.4 times greater than the incident solar radiation respectively).*

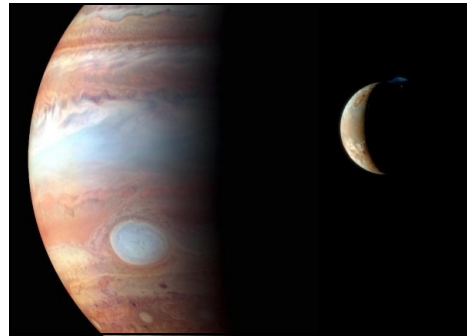


Figure 16.1 Jupiter

This suggests Jupiter’s insulated heat lies under the cover of a deep blanket cloud. Saturn is cooling more rapidly due to an effective condensation path. See Chapter 9 – Giant Planet Cloud Condensing.

Jupiter is the largest planet in the Solar System and surrounded by at least 67 satellites and a faint ring system. The four major Galilean satellites are illustrated, with Io shown previously exhibiting a faint volcanic plume.<sup>57</sup>

*The inner satellite group (or Amalthea group), is made up of four small moons that have diameters of less than 200 km, orbit at radii less than 200,000 km, and have orbital inclinations of less than half a degree. This groups includes the moons of Metis, Adrastea, Amalthea, and Thebe.*



Figure 16.2 Galilean Satellites

Four bands of orbiting Jupiter satellites exist – other than Mars and the Asteroid Belt, and are described as Irregular Satellites.<sup>58</sup>

*Jupiter's outer moons and their highly inclined orbits. - The irregular satellites are substantially smaller objects with more distant and eccentric orbits. They form families with shared similarities in orbit (semi-major axis, inclination, eccentricity) and composition.*

### *Prograde satellites:*

*Themisto[33] is the innermost irregular moon and not part of a known family.*

*The Himalia group is spread over barely 1.4 Gm in semi-major axes, 1.6° in inclination ( $27.5 \pm 0.8^\circ$ ), and eccentricities between 0.11 and 0.25. It has been suggested that the group could be a remnant of the break-up of an asteroid from the asteroid belt.*

*Carpo is the outermost prograde moon and not part of a known family.*

### *Retrograde satellites:*

*S/2003 J 12 and S/2011 J 1 are the innermost of the retrograde moons, and are not part of any known family.*

*The Carme group is spread over only 1.2 Gm in semi-major axis, 1.6° in inclination ( $165.7 \pm 0.8^\circ$ ), and eccentricities between 0.23 and 0.27. It is very homogeneous in color (light red) and is believed to have originated from a D-type asteroid progenitor, possibly a Jupiter Trojan.*

*The Ananke group has a relatively wider spread than the previous groups, over 2.4 Gm in semi-major axis, 8.1° in inclination (between  $145.7^\circ$  and  $154.8^\circ$ ), and eccentricities between 0.02 and 0.28. Most of the members appear gray, and are believed to have formed from the breakup of a captured asteroid.*

*The Pasiphae group is quite dispersed, with a spread over 1.3 Gm, inclinations between  $144.5^\circ$  and  $158.3^\circ$ , and*

<sup>56</sup> Highlights of Astronomy: As presented at the XIVth General Assembly “Jupiter and Saturn rate of heat emission”

<sup>57</sup> <http://www.universetoday.com/14469/jupiter/>

<sup>58</sup> [https://en.wikipedia.org/wiki/Moons\\_of\\_Jupiter](https://en.wikipedia.org/wiki/Moons_of_Jupiter)



*eccentricities between 0.25 and 0.43. The colors also vary significantly, from red to grey, which might be the result of multiple collisions. Sinope, sometimes included in the Pasiphae group, is red and, given the difference in inclination, it could have been captured independently;[33] Pasiphae and Sinope are also trapped in secular resonances with Jupiter.*

*S/2003 J 2 is the outermost moon of Jupiter, and is not part of a known family.*

This treatise proposes that the grouping and orbit arrangement of these satellites can be explained by considering their launch mechanisms, and following the launch of Mars and the Asteroid belt. See Chapter 15. All the posigrade orbiting satellites were the first to launch as shown in Figure 15.6

Group two comprises the large ‘Galilean Satellites’ Io, Europa, Ganymede, and Callisto. These have densities reducing with increasing distance from Jupiter (3.5, 3.3, 1.9, 1.6). The reducing densities are probably due to increasing proportions of water. Ganymede shows a magnetic field suggesting it has a molten iron core. This could be due to the satellite launching when an inner core of Jupiter ruptured and ejected iron with the satellite.

Water was probably stripped subsequently from the innermost satellites due to the proximity of Jupiter. See Paragraph 8.7 – Satellites And Water.

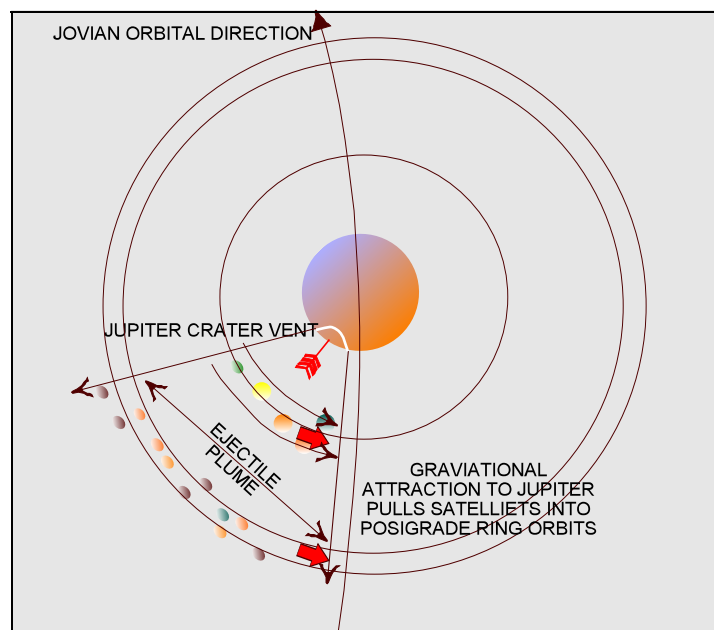


Figure 16.3 – Jupiter Satellite Development - Stage 2

Group three is four smaller satellites, Leda, Himalia, Elara, and Lysithea. Orbits for group three differ in that they are steeply inclined to the planet's equatorial plane. However, groups 1-3 all have posigrade orbit directions. This is the same orbiting direction as Mars, the Asteroids, and most planets.

However, the fourth outermost satellite cluster of four small bodies (Pasiphae, Sinope, Carme, & Ananke) all have retrograde orbits. Opposing orbits in this satellite group suggest an unusual origin. It is possible that they were

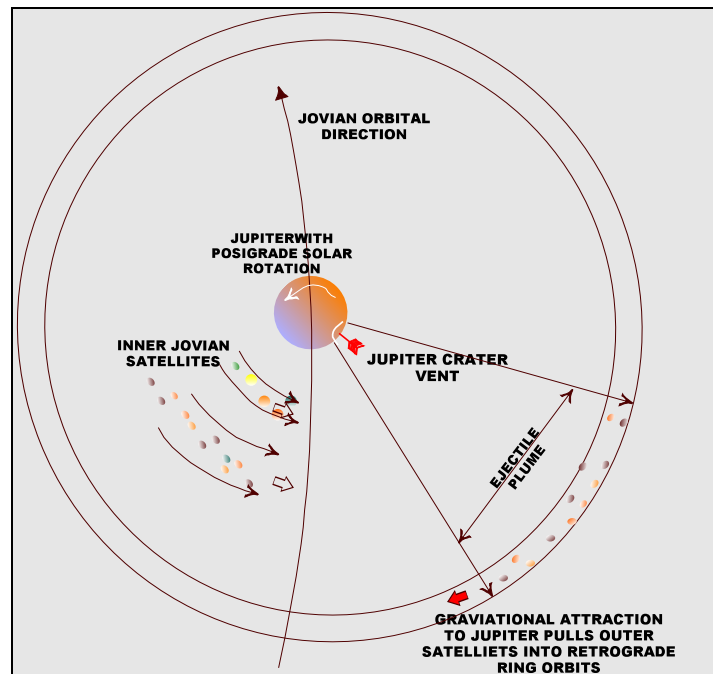


Figure 16.4 – Jupiter Satellite Development - Stage 3

particles on the leading edge of the original Eye jet blast that provided a sufficiently retrograde orbit component to establish the satellite cluster. However, such an unusual trajectory is hard to imagine.

A more plausible explanation relates to the large size of the planet Jupiter. The proposed sequence of events shows in Figures 15.1, 16.3, 16.4, and subsequently 16.5 Both outer satellite groups show very erratic orbits. They are consistent with particles launching into a region where gravitation components from both the Sun and Jupiter are acting in the same direction. This soon alters to the Sun acting against Jupiter as the satellites swing between the two masses for the first time. Minor differentiation of these two gravitation components results in widely dissimilar elliptical paths.

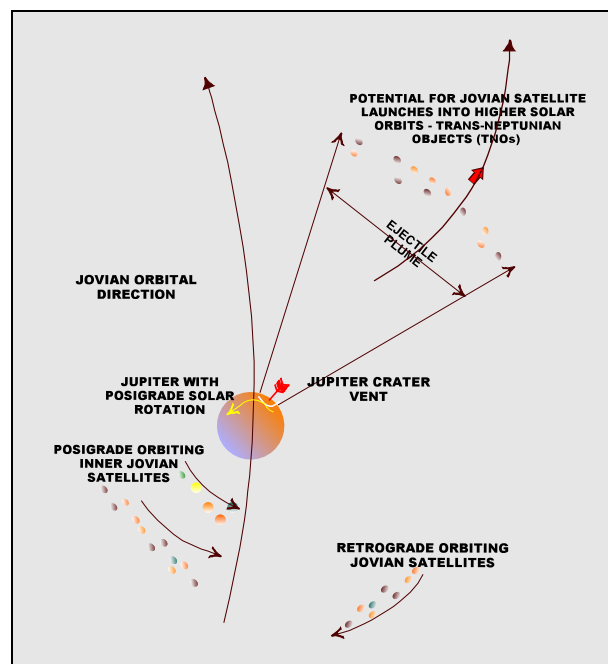


Figure 16.5 – Jupiter Satellite Development - Stage 4

It is possible that the original ejectile phase was so dramatic that it:- provided Jupiter with a solar rotation, and

launched Mars, the Asteroid belt, and three inner satellite rings. This event probably also continued for a sufficiently long period for the ejectile plume to cross behind the orbiting path of Jupiter. As the plume aligned with the orbiting path, it pushed Jupiter into a higher solar orbit. This also prevented Mars and the Asteroids from re-entering the Jovian gravitational system.

Once the plume crossed the orbiting path, any satellites launched would have a retrograde orbiting direction. (A similar situation occurs with the outermost satellite Phoebe at Saturn.) This logic suggests that the outer Jovian satellites were the penultimate objects launched, and possibly represent material separated from a rupturing inner shell of the great planet. However, as the ejectile plume moved ahead of Jupiter's solar path direction, it is possible for satellites to launch with a faster (higher) solar rotation speed than Jupiter's which will put them into more remote solar orbits. Pluto, Eris, Kuiper Belt and Oort Cloud objects are possible candidates for this type of origin. See Chapter 20 Kuiper Belt and Oort Cloud.

Saturn is also a possible launch site, but less likely due to its smaller size - only 29.7% of Jupiter, and of the enormous energy potential inherent in a large planet like Jupiter.

The following extract provides an interesting comparison of the two large outer satellites of the Galilean Group.<sup>59</sup>

*(b) Geology of Ganymede and Callisto*

*Callisto and Ganymede provide an excellent introduction to the geology of icy worlds. We begin with Callisto, the simpler of the two. The entire surface of Callisto is covered with impact craters, like the lunar highlands (Figure 18.3). The existence of this heavily cratered surface tells us three important things not known before Voyager: (1) an icy planet can form and retain impact craters in its surface, (2) there was a heavy bombardment by debris in the outer solar system as well as nearer the sun, and (3) Callisto has experienced little if any geological activity other than impacts for a long time – probably billions of years.*

*Calculations suggest that impacts occurring now in the outer solar system are primarily from comets, and that the impact rates should be roughly half as great as in the inner solar system. If correct, these calculated current rates could not accumulate as many craters over the entire history of the solar system as are seen on Callisto. Therefore, Callisto tells us that there was a heavy bombardment in the outer solar system too, probably at about the same time that the heavily cratered surfaces of Moon, Mars, and Mercury formed.*

*The craters of Callisto do not look exactly like their counterparts in the inner solar system. They tend to be much flatter, as if the surface did not have the strength to support much vertical relief. Such subdued topography is to be expected for an ice crust at the temperatures of 130 to 140° K measured near local noon on Callisto, since ice loses some of its strength as it is warmed. Farther from the sun, in the Saturn system, temperatures are so low that ice is as strong as rock.*

*Ganymede, the largest satellite in the solar system, is also cratered but less so than Callisto. About one-third of its surface seems to be contemporary with Callisto; the rest formed later, after the end of the heavy bombardment period. This younger terrain on Ganymede is probably about as old as the lunar maria or the Martian volcanic plains, judging from crater counts.*

<sup>60</sup>*The Galileo spacecraft was the first to enter orbit around Jupiter, arriving in 1995 and studying it until 2003. During this period, Galileo gathered a large amount of information about the Jovian system, making close approaches to all of the Galilean moons and finding evidence for thin atmospheres on three of them, as well as the possibility of liquid water beneath the surfaces of Europa, Ganymede, and Callisto. It also discovered a magnetic field around Ganymede.*

Callisto – the outermost Galilean satellite, is more cratered than Ganymede. This is consistent with Callisto acting as a 'sweeper' for other orbiting particles descending from orbits further out. The launch mechanism

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<sup>59</sup> Abell, Morrison, Wolff, *Exploration of the Universe*, CBS College Pub. 1987, p351-352

<sup>60</sup> [https://en.wikipedia.org/wiki/Moons\\_of\\_Jupiter](https://en.wikipedia.org/wiki/Moons_of_Jupiter)

proposed for the fourth group of retrograde satellites also produces a great deal of unstable orbiting spatter material. Retrograde orbits are inherently more unstable than prograde orbits and these particles would descend to orbits in Callisto's path.

Here, '*the heavy bombardment in the outer solar system*' restricts to particles returning to their parent bodies, rather than being a general statement of truant bodies freely navigating the outer Solar System.

#### **Chapter 16. Interim Conclusions**

- 1) Jupiter radiates 2.7 times more heat than it receives from the Sun which shows it has a substantial energy source coming from within.
- 2) The rate of energy release from Jupiter today can be expected to be considerably less than it was in Archaean times. This means that Jupiter provided the most violent contributions to the formation of the Solar System as a whole, and only surpassed by the Sun.
- 3) Jupiter provided sufficient energy to launch Mars, the Asteroid Belt, Moons of Jupiter, the Kuiper and Oort Cloud objects.

17  
*SATURN AND HYPERION*

- 17.1 **SATURN** is the second largest planet with mass of 95.2EMU. The lesser mass suggests Saturn's Dynamic Stage is more advanced than Jupiter's (at 318EMU). Spectacular ring formations show the planet has developed into/through the climax Projectile Stage. It implies that a Solidus Stage is complete and a floating Proto Continent could exist in a sea of magma in the Terrafirma Stage. See Section 12—Dynamic Geological Time Scale.

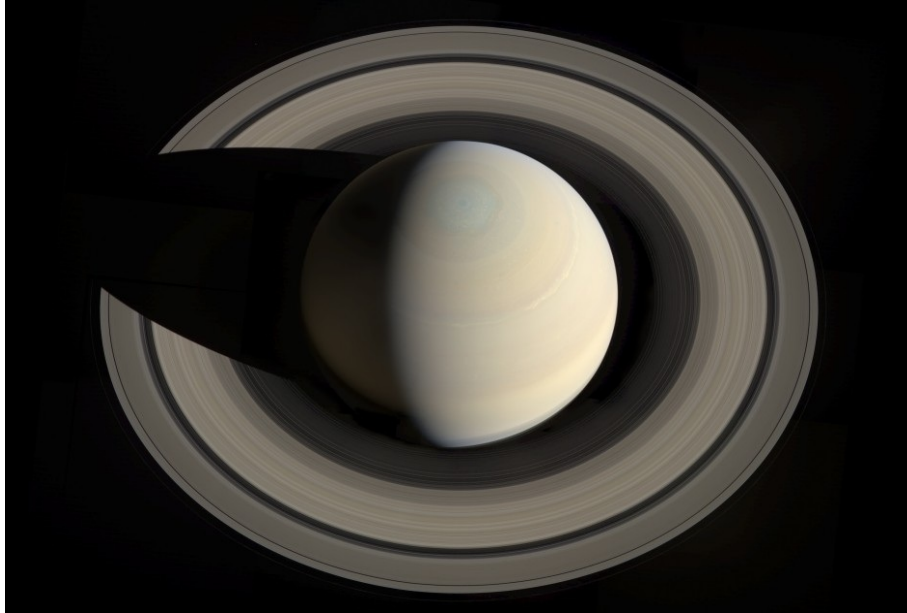


Figure 17.1 - Saturn

Eye activity has diminished to the point where the hot spot location is no longer clearly evident through the upper swirling cloud mass. Saturn's cloud is less banded and more diffuse than Jupiter's. As this planet advances through the rapid condensation phase, the eye spot may again become sporadically visible as it is on Neptune. Saturn's surface is probably the hottest in the Solar System, after the Sun and Jupiter.

The satellite system at Saturn is broadly summarised in:<sup>61</sup>

*Saturn is one of the four gas giants in our Solar System, also known as the Jovian planets, and the sixth planet from the Sun. It's ring system, which it is famous for, is also the most observable – consisting of nine continuous main rings and three discontinuous arcs.- Saturn periodically has what's known as the Great White Spot (aka. Great White Oval). This unique but short-lived phenomenon occurs once every Saturnian year, roughly every 30 Earth years, around the time of the northern hemisphere's summer solstice. - Saturn has at least 150 moons and moonlets, but only 53 of these moons have been given official names. Of these moons, 34 are less than 10 km in diameter and another 14 are between 10 and 50 km in diameter. However, some of its inner and outer moons are rather large, ranging from 250 to over 5000 km.*

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<sup>61</sup> <http://www.universetoday.com/15298/saturn/>

*Saturn's rings and moons, shown to scale. Credit: NASA.*

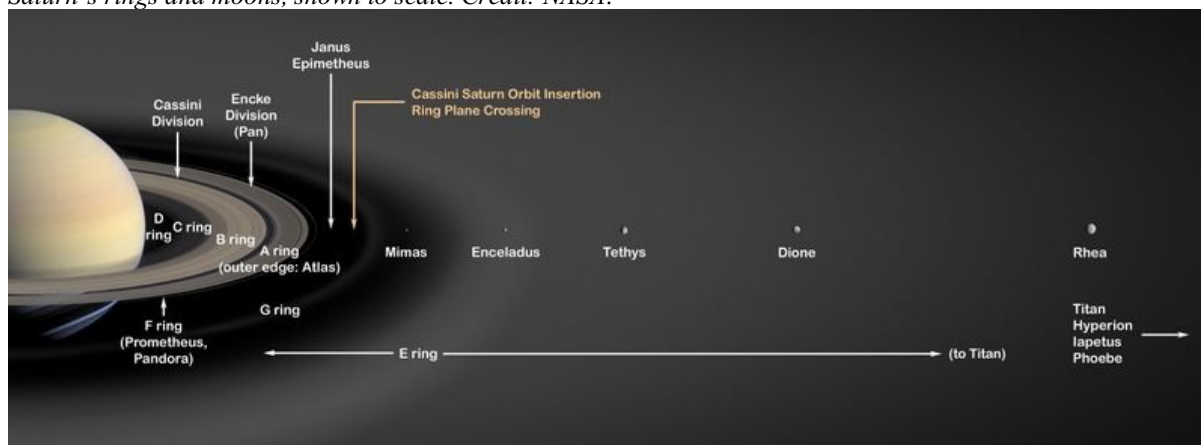


Figure 17.2 - Saturn Satellite Radial Distribution

## 17.2 HYPERION

*Hyperion is Titan's immediate neighbor. At an average diameter of about 270 km, it is smaller and lighter than Mimas. It is also irregularly shaped and quite odd in composition. Essentially, the moon is an ovoid, tan-colored body with an extremely porous surface (which resembles a sponge). The surface of Hyperion is covered with numerous impact craters, most of which are 2 to 10 km in diameter. It also has a highly unpredictable rotation, with no well-defined poles or equator.*

What a remarkable story<sup>62</sup> the Cassini spacecraft picture of Hyperion tells. As a mining engineer, I see a classic out-bursting pattern on the face of this satellite with typical inverted cone structures showing all over the surface. Indeed a two stage event appears with a large outburst crater in filled with many smaller expulsion cavities. The "inverted cones" remind me of gas outbursts seen at some deep coal mines where pent up pressure escapes forcefully. It tells me Hyperion has come from a region of high pressure to one of low pressure. The nearest candidate for such an origin is Saturn itself. Hyperion probably launched from Saturn before its gaseous contents were explosively liberated. The contents formed into icy rings visible from earth.



Figure 17.3 - Hyperion

Saturn's rings are very reflective (unlike those at Jupiter and Uranus) suggesting a high ice content. High ice content in these rings indicate they projected into orbit through Kinetic Pipe activity.

Saturn's mass is consistent with a stage in development where fragments of Si-rich material and condensates form orbiting rings. Particles in the rings are probably similar in composition to comet material and it is possible that recent comets originate from Saturn, but launched into elliptical solar orbits. See Section 7-Escape Velocity. Differing radii of the rings suggests several Kinetic Pipes were, or are still active. Shepherding has also occurred through Kirkwood Gap activity. Further evidence for this stage of development comes from the GWS (Great White Spot) activity observed in the northern hemisphere at Saturn. See Section 10-Kinetic Pipes.

The satellites of Saturn differ from Jupiter's in that they have generally increasing density associated with increasing orbit distance. The innermost bodies (also associated with the ring structures) generally have heavily cratered surfaces. This is consistent with satellites and projectiles coming from recent, and possible still active Projectile Stage activity. This stage produces rings and smaller satellites, many of which probably have fairly unstable orbits. They were also of lesser density and therefore have lower angular momentums than the more stable dark ring structures.

The second and third groups of outer satellites conform to Eye Stage initiation. The satellite ring structures are projectile products, and the planet is most probably in Mid-Late Projectile Stage (equals 3.3B.y. ago on Earth).

Recent exploration information of Saturn shows there are reported to be 62 satellites with 58 defined as

<sup>62</sup> National Geographic April 06

discussed. Figure 17.4 illustrates the orbiting complex of these satellites.<sup>63</sup>

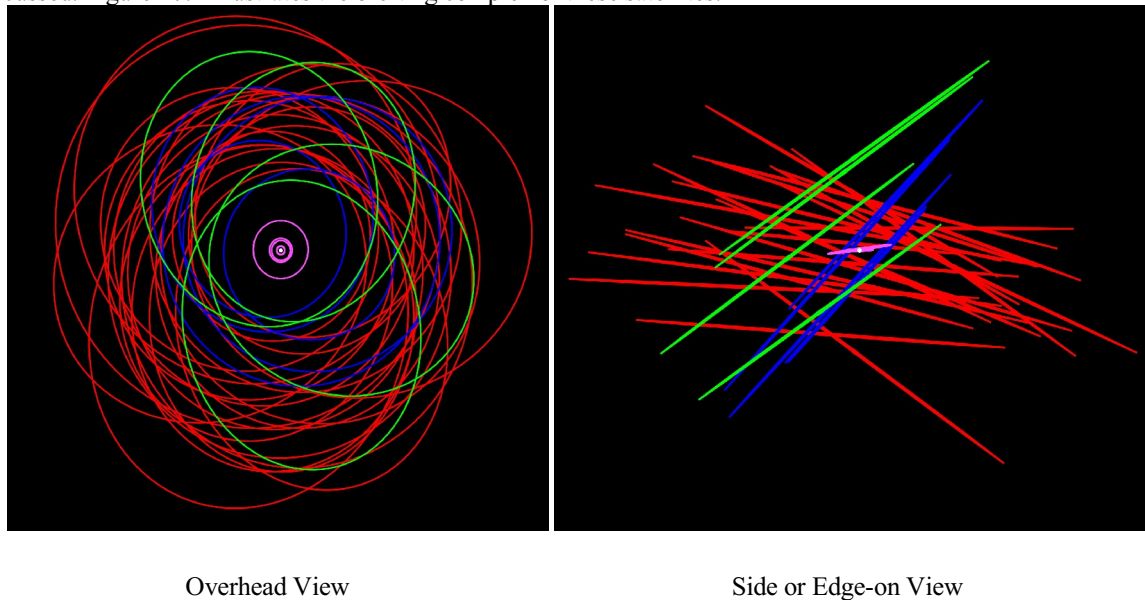


Figure 17.4 Saturn Satellite Orbits

*Saturn's satellite system is very lopsided: one moon, Titan, comprises more than 96% of the mass in orbit around the planet. The six other planemo (ellipsoidal) moons constitute roughly 4% of the mass, and the remaining 55 small moons, together with the rings, comprise only 0.04%.*

*Although the boundaries may be somewhat vague, Saturn's moons can be divided into ten groups according to their orbital characteristics. Many of them, such as Pan and Daphnis, orbit within Saturn's ring system and have orbital periods only slightly longer than the planet's rotation period.[36] The innermost moons and most regular satellites all have mean orbital inclinations ranging from less than a degree to about 1.5 degrees (except Iapetus, which has an inclination of 7.57 degrees) and small orbital eccentricities.[37] On the other hand, irregular satellites in the outermost regions of Saturn's moon system, in particular the Norse group, have orbital radii of millions of kilometers and orbital periods lasting several years. **The moons of the Norse group also orbit in the opposite direction to Saturn's rotation.**<sup>64</sup> This group consists of 29 retrograde outer moons. See Table 17.1*

<sup>63</sup> <http://home.dtm.ciw.edu/users/sheppard/satellites/satsatdata.html>

<sup>64</sup> [https://en.wikipedia.org/wiki/Moons\\_of\\_Saturn](https://en.wikipedia.org/wiki/Moons_of_Saturn)

## RETROGRADE ORBITS (NORSE GROUP) \*\*

## SATURN SATELLITE TABLE

Name			a	i	e	Peri	Node	M	Period	mag H	Size	Year
			(km)	(deg)		(deg)	(deg)	(deg)	(days)	(mag)	(km)	
<b>REGULAR SATELLITES</b>												
<b>Start of Inner most Ring (D)</b>			66000									
		S/2009	S1	117000	0	0	0	0	0	28	0.3	2009
XVIII	Pan	S/1981	S13	133600	0	0	0	122	0.575	19	20	1981
XXXV	Daphnis	S/2005	S1	136500	0	0	0	0	0.594	24	7	2005
XV	Atlas	S/1980	S28	137700	0	0	0	186.5	0.602	18.5	32	1980
XVI	Prometheus	S/1980	S27	139400	0	0.002	212.8	0	335.7	0.613	15.5	100 1980
XVII	Pandora	S/1980	S26	141700	0	0.004	68.2	0	13.9	0.629	16	84 1980
XI	Epimetheus	S/1980	S3	151400	0.335	0.021	100.9	335	56	0.69	15	119 1980
X	Janus	S/1980	S1	151500	0.165	0.007	27.9	303.8	236.5	0.7	14	178 1980
LIII	Aegaeon	S/2008	S1	167500	0.001	0	0	0	0.808	27	0.5	2008
I	Mimas			185539	1.574	0.02	332.5	173	14.85	0.94	12.5	397 1789
XXXII	Methone	S/2004	S1	194000	0	0	0	0	1.01	25	3	2004
XLIX	Anthe	S/2007	S4	197700	0.1	0.001	0	0	0	1.04	26	1 2004
XXXIII	Pallene	S/2004	S2	211000	0	0	0	0	1.14	25	4	2004
II	Enceladus			238042	0.003	0	8	342.5	199.7	1.37	11.5	499 1789
III	Tethys			294672	1.091	0	45.2	259.8	243.4	1.89	10	1060 1684
XIII	Teleso	S/1980	S13	294720	1.118	0.001	80.7	126.1	7.9	1.89	18	24 1980
XIV	Calypso	S/1980	S25	294720	1.5	0.001	43.6	209.2	201.8	1.89	18.5	19 1980
XXXIV	Polydeuces	S/2004	S5	377220	0.175	0.019	0	0	0	2.74	25	4 2004
IV	Dione			377415	0.028	0.002	284.3	290.4	322.2	2.74	10	1118 1684
XII	Helene	S/1980	S6	377440	0.213	0	80.4	10.2	10	2.74	18	32 1980
<b>End of Outer most Ring (E)</b>			480000									
V	Rhea			527068	0.333	0	241.6	351	179.8	4.518	9	1528 1672
VI	Titan			1221865	0.306	0.029	180.5	28.06	163.3	15.95	8	5150 1655
VII	Hyperion			1500933	0.615	0.023	303.2	263.8	86.34	21.28	14	266 1848
VIII	Iapetus			3560854	8.298	0.029	271.6	81.11	201.8	79.33	10.5	1436 1671
<b>IRREGULAR SATELLITES</b>												
XXIV	Kiviuq	S/2000	S5	11111000	45.71	0.334	82.87	359.5	221.2	449.2	22	16 2000
XXII	Ijiraq	S/2000	S6	11124000	46.44	0.316	85.46	136.4	64.55	451.4	22.6	12 2000
IX	Phoebe **			12944300	174.8	0.164	337.5	237.1	174.6	548.2	16	240 1898
XX	Paaliaq	S/2000	S2	15200000	45.13	0.364	238.3	327.2	352	686.9	21.3	22 2000
XXVII	Skathi **	S/2000	S8	15541000	152.6	0.27	201.8	284	144.6	728.2	23.6	8 2000
XXVI	Albiorix	S/2000	S11	16182000	33.98	0.478	55.48	102.3	58.72	783.5	20.5	32 2000
XXXVII	Bebhionn	S/2004	S11	17119000	35.01	0.469	6.09	194.4	262.8	834.8	24.1	6 2004
XXVIII	Erriapus	S/2000	S10	17343000	34.62	0.474	282.1	150.8	323.2	871.2	23	10 2000
XXIX	Siarnaq	S/2000	S3	17531000	45.56	0.295	65.44	47.09	224.6	895.6	20.1	40 2000
XLVII	Skoll **	S/2006	S8	17665000	161.2	0.464	198.3	300	79.6	878.3	24.5	6 2006
XXI	Tarvos	S/2000	S4	17983000	33.82	0.531	273.5	102.9	283.6	926.2	22.1	15 2000
LII	Tarqeq	S/2007	S1	18009000	46.09	0.16	30.97	82.04	337.9	887.5	23.9	7 2007
LI	Greip **	S/2006	S4	18206000	179.8	0.326	202.4	41.83	322.4	921.2	24.4	6 2006
XLIV	Hyrrokkin **	S/2004	S19	18437000	151.4	0.333	278.1	50.6	289	931.8	23.5	8 2004
XXV	Mundilfari **	S/2000	S9	18685000	167.3	0.21	310.1	83.51	108.3	952.6	23.8	7 2000
L	Jamsaxa **	S/2006	S6	18811000	163.3	0.216	245.7	24.16	177.1	964.7	24.7	6 2006
XXXI	Narvi **	S/2003	S1	19007000	145.8	0.431	178.5	182.3	203.7	1003.9	23.8	7 2003
XXXVIII	Bergelmir **	S/2004	S15	19338000	158.5	0.142	138.9	206.2	248.9	1005.9	24.2	6 2004
XXIII	Suttungr **	S/2000	S12	19459000	175.8	0.114	35.73	228.4	340.1	1016.7	23.9	7 2000
XLIII	Hati **	S/2004	S14	19856000	165.8	0.372	25.57	327.6	79.3	1038.7	24.4	6 2004
XXXIX	Bestla **	S/2004	S18	20129000	145.2	0.521	87.11	295.3	148.6	1083.6	23.8	7 2004
XL	Farbauti	S/2004	S09	20390000	156.4	0.206	350	140.1	176	1086.1	24.7	5 2004
XXX	Thrymr **	S/2000	S7	20474000	176	0.47	63.45	223.9	18.03	1094.3	23.9	7 2000
XXXVI	Aegir **	S/2004	S10	20735000	166.7	0.252	250.8	186	262.8	1116.5	24.4	6 2004
XLV	Kari **	S/2006	S2	22118000	156.3	0.478	170.9	286.5	106.7	1233.6	23.9	7 2006
XLI	Fenrir	S/2004	S16	22453000	164.9	0.136	126.6	230.5	299.7	1260.3	25	4 2004
XLV/III	Surtur **	S/2006	S7	22707000	177.5	0.451	22.6	313.3	294	1297.7	24.8	6 2006
XIX	Ymir **	S/2000	S1	23040000	173.1	0.335	22.58	194	244.1	1315.4	21.7	18 2000
XLVI	Loge **	S/2006	S5	23065000	167.9	0.187	39.61	349.8	126.3	1312	24.6	6 2006
XLII	Fornjot **	S/2004	S08	25108000	170.4	0.206	330.8	264.9	299.9	1490.9	24.6	6 2004
<b>NEW DISCOVERIES YET TO BE NAMED:</b>												
	**	S/2004	S07	19800000	165.1	0.58	0	0	0	1103	24.5	6 2004
	**	S/2004	S12	19650000	164	0.401	0	0	0	1048	24.8	5 2004
	**	S/2004	S13	18450000	167.4	0.273	0	0	0	906	24.5	6 2004
	**	S/2004	S17	18600000	166.6	0.259	0	0	0	986	25.2	4 2004
	**	S/2006	S1	18981135	154.2	0.13	0	0	0	970	24.6	6 2006
	**	S/2006	S3	21132000	150.8	0.471	0	0	0	1142	24.6	6 2006
	**	S/2007	S2	16560000	176.7	0.218	0	0	0	800	24.4	6 2007
	**	S/2007	S3	20518500	177.2	0.13	0	0	0	1100	24.9	5 2007
<b>KEYS</b>												
a - The mean semi-major axis.												
i - The mean inclination.												
e - The mean eccentricity.												
Peri - The argument of Periaphis.												
Node - The longitude of the ascending node.												
M - The mean anomaly.												
Period - The time of one revolution around Saturn												
mag - The optical magnitude of the object (R-band).												
H - The absolute magnitude of the object.												
Size - The diameter of the object.												
Year - The year of discovery.												

Table 17.1 Saturn Satellites

## Chapter 17. Interim Conclusions

- 1) Saturn is the most dramatic ring display planet in the Solar System.
- 2) Saturn is probably in Mid-Late Projectile Stage (equal to 3.3B.y. ago on Earth).
- 3) The ring structure is launched from Saturn in an ongoing series of eruptions, and Hyperion provides tangible details of how this material originates.



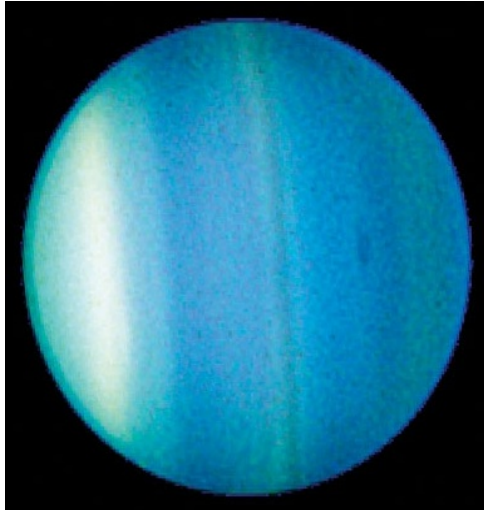


Figure 18.1 - Uranus, as imaged by the Hubble Space Telescope

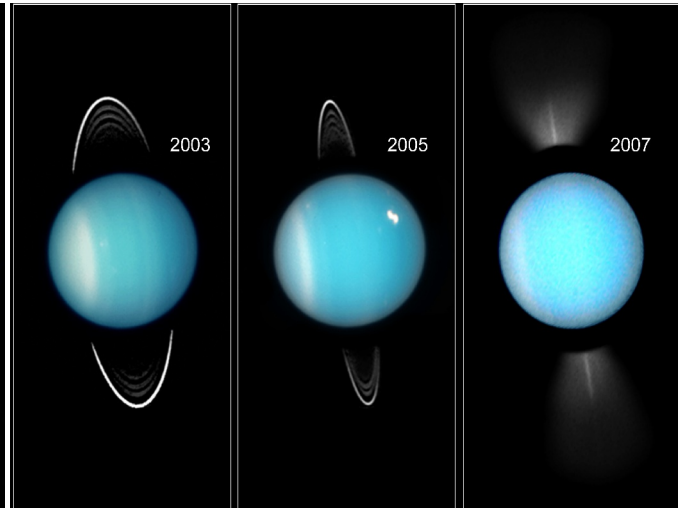


Figure 18.2 - Uranus cloud formations over time

*Uranus is the third largest planet in our Solar System, ranking behind Jupiter and Saturn. Like its fellow gas giants, it has many moons, a ring system, and is primarily composed of gases that are believed to surround a solid core. - Its low density means that while it is the third largest of the gas giants, it is the least massive (falling behind Neptune by 2.6 Earth masses).<sup>66</sup> One unique feature of Uranus is that it rotates on its side. See Figure 18.1*

Over time the planet has displayed variations in the upper cloud mass indicating the presence of a continuing dynamic energy system. See Figure 18.2

This planet is 14.6 EMU (cw Neptune at 17.2 EMU) and is between 18.28 and 20.08 Astronomical Units (AU) from the Sun. Only a comparatively small amount of radiated energy from the Sun reaches Uranus. The polar axis tilts at 82.1° to the ecliptic.<sup>67</sup> The planetary magnetic field is also inclined at 60° to the rotational axis indicating an unusual magmatic flow direction.

Further, the polar regions are slightly warmer than the equatorial region, although the cloud deck temperature is only 75°K. See Figure 18.1

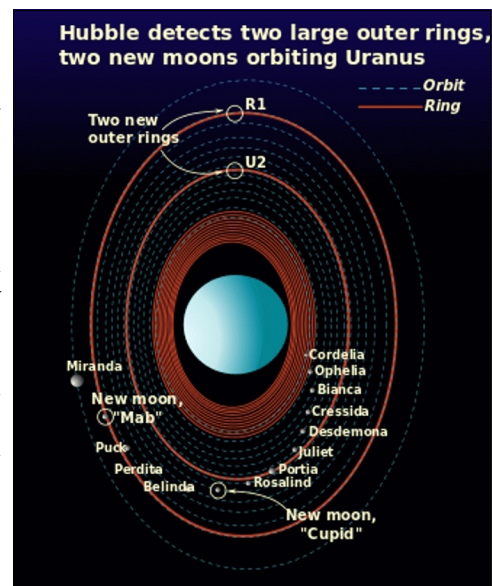


Figure 18.3 - Uranus Moons

<sup>65</sup> Image credit: NASA/Hubble

<sup>66</sup> <http://www.universetoday.com/18855/uranus/>

<sup>67</sup> David Baker, *Astronomy*, Country Life Books, 6th Imp. The Hamlyn Pub, 1986. p206

Uranus has 27 known moons as summarised in Table 18.1<sup>68</sup>, and Figure 18.3

Retrograde Orbits (NORSE GROUP) \*\*

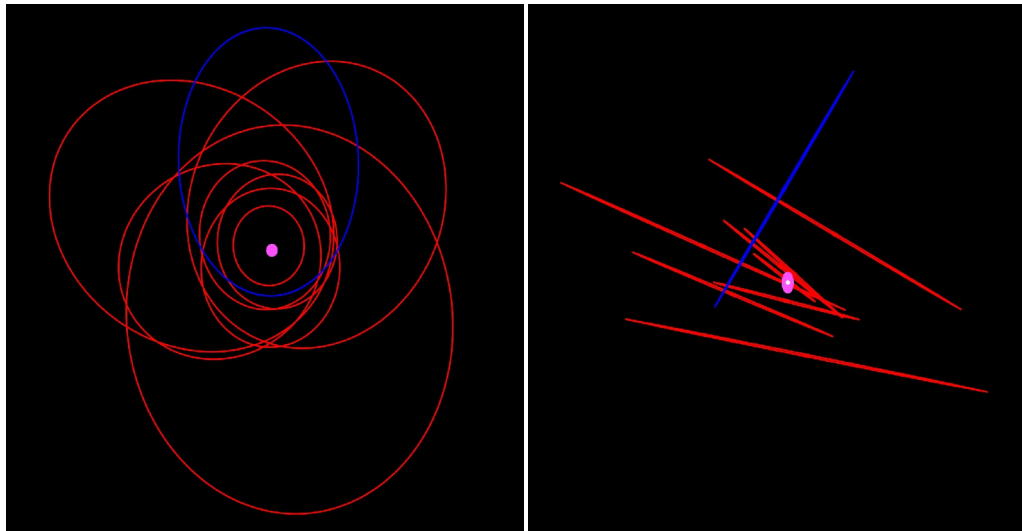
Uranus Satellite Data														
Name				a	i	e	Peri	Node	M	Period	mag	H	Size	Year
				(km)	(deg)	(deg)		(deg)	(deg)	(days)			(km)	
Regular Satellites														
VI	Cordelia	S/1986	U7	49800	0.085	0	136.8	38.4	254.8	0.335	23.1		40	1986
VII	Ophelia	S/1986	U8	53800	0.104	0.01	17.8	164	116.3	0.376	22.8		42	1986
VIII	Bianca	S/1986	U9	59200	0.193	0.001	8.3	93.2	138.5	0.435	22		51	1986
IX	Cressida	S/1986	U3	61800	0.006	0	44.2	99.4	233.8	0.464	21.1		80	1986
X	Desdemona	S/1986	U6	62700	0.113	0	183.2	306.1	184.6	0.474	21.5		64	1986
XI	Juliet	S/1986	U2	64400	0.065	0.001	223.8	200.2	244.7	0.493	20.6		93	1986
XII	Portia	S/1986	U1	66100	0.059	0	222.4	260.1	218.3	0.513	19.9		135	1986
XIII	Rosalind	S/1986	U4	69900	0.279	0	140.5	12.8	136.1	0.558	21.3		72	1986
XXVII	Cupid	S/2003	U2	74392	0.099	0.001	247.6	182.8	163.8	0.613	26		10	2003
XIV	Belinda	S/1986	U5	75300	0.031	0	42.4	279.3	357.2	0.624	21		80	1986
XXV	Perdita	S/1986	U10	76417	0.47	0.012	253.9	309.4	192.4	0.638	24		20	1986
XV	Puck	S/1985	U1	86000	0.319	0	177.1	268.7	245.8	0.762	19.2		162	1985
XXVI	Mab	S/2003	U1	97736	0.134	0.002	249.6	350.7	273.8	0.923	26		10	2003
V	Miranda			129900	4.338	0.001	68.3	326.4	311.3	1.41	15.3		471	1948
I	Ariel			190900	0.041	0.001	151.3	22.4	39.5	2.52	13.2		1158	1851
II	Umbriel			266000	0.128	0.004	84.7	33.5	12.5	4.14	14		1169	1851
III	Titania			436300	0.079	0.001	284.4	99.8	24.6	8.71	13		1578	1787
IV	Oberon			583500	0.068	0.001	104.4	279.8	283.1	13.46	13.2		1522	1787
Irregular Groups														
XXII	Francisco **	S/2001	U3	4276000	145.2	0.146	124.7	93.1	90.9	266.6	25		22	2001
XVI	Caliban **	S/1997	U1	7231000	140.9	0.159	342.6	163.5	163.1	579.7	22.4		72	1997
XX	Stephano **	S/1999	U2	8004000	144.1	0.229	19	188.1	82.2	677.4	24.1		32	1999
XXI	Trinculo **	S/2001	U1	8504000	167.1	0.22	159.8	194.9	22.3	759	25.4		18	2001
XVII	Sycorax **	S/1997	U2	12179000	159.4	0.522	19.9	260.9	170.2	1288.3	20.8		150	1997
XXIII	Margaret	S/2003	U3	14345000	56.6	0.661	89.4	3.5	322.4	1694.8	25.2		20	2003
XVIII	Prospero **	S/1999	U3	16256000	152	0.445	175.6	316.8	180.9	1977.3	23.2		50	1999
XIX	Setebos **	S/1999	U1	17418000	158.2	0.591	1.5	247.6	126.4	2234.8	23.3		47	1999
XXIV	Ferdinand **	S/2001	U2	20901000	169.8	0.368	159.6	216.4	234.5	2823.4	25.1		21	2003
a - The mean semi-major axis.														
i - The mean inclination.														
e - The mean eccentricity.														
Peri - The argument of Pariaphis.														
Node - The longitude of the ascending node.														
M - The mean anomaly.														
Period - The time of one revolution around Uranus.														
mag - The optical magnitude of the object (R-band).														
H - The absolute magnitude of the object.														
Size - The diameter of the object.														
Year - The year of discovery.														

Table 18.1 Uranus Moon Statistics

Margaret, is the only known irregular moon of Uranus with a posigrade orbit.<sup>69</sup> Margaret also has a steeply inclined orbit as displayed by the blue track shown in Figure 18.4 which suggests a different launch campaign to the other Uranus satellites, and may indicate an early launch sequence before the planet's unusual solar orbit stabilised.

<sup>68</sup> [https://upload.wikimedia.org/wikipedia/commons/thumb/5/58/Uranian\\_system\\_schematic-en.svg/330px-Uranian\\_system\\_schematic-en.svg.png](https://upload.wikimedia.org/wikipedia/commons/thumb/5/58/Uranian_system_schematic-en.svg/330px-Uranian_system_schematic-en.svg.png)

<sup>69</sup> [https://en.wikipedia.org/wiki/Moons\\_of\\_Uranus](https://en.wikipedia.org/wiki/Moons_of_Uranus)



Overhead View of Moon Orbits

Side View of Moon Orbits

Figure 18.4 - Uranus Moon Orbits

Uranus experienced minimal solar warming during the Accretion Stage. This may have further waned due to a small axial rotation developed during accretion. It is likely that no significant Solar soft spot formed on the original surface of Uranus. Internal pressure buildup eventually caused the outer planet shell to rupture near one sidereal pole. See Chapter 4 - Weightless Convection Currents.

The satellites launched and Uranus got a technically retrograde orbit with the axis parallel to the ecliptic plane. Comet P/Tempel-Tuttle 1866 1 with associated Leonid meteor shower, possibly ejected and moved into a solar orbit during this period.<sup>70</sup>

Satellites and ring structures at Uranus represent an Eye Stage launch through an existing atmosphere of volatiles. Hence the low satellite densities.

Skeletal ring structures, observed during the Voyager II mission, are probably residual Fe-rich Eye Stage rings, (equivalent to 4By ago on Earth). Further evidence for these rings being Fe-rich is the dark colour, and are in stark contrast to Saturn's light coloured rings.

*All major moons comprise approximately equal amounts rock and ice, except Miranda, which is made primarily of ice. The ice component may include ammonia and carbon dioxide.*<sup>71</sup>

The mass of the planet suggests, it is at the Mid Terraforma Stage and the Proto Continent forming. This would be just before massive atmospheric condensation. However a lack of radiant heat from the planet implies that a high mountain range never formed on Uranus and cloud condensation cannot proceed.<sup>72</sup>

*Uranus's internal heat appears markedly lower than that of the other giant planets; in astronomical terms, it has a low thermal flux.[17][68] Why Uranus's internal temperature is so low is still not understood. Neptune, which is Uranus's near twin in size and composition, radiates 2.61 times as much energy into space as it receives from the Sun,[17] but Uranus radiates hardly any excess heat at all. The total power radiated by Uranus in the far infrared (i.e. heat) part of the spectrum is  $1.06 \pm 0.08$  times the solar energy absorbed in its atmosphere.[12][69] Uranus's heat flux is only  $0.042 \pm 0.047$  W/m<sup>2</sup>, which is lower than the internal heat flux of Earth of about 0.075 W/m<sup>2</sup>. [69] The lowest temperature recorded in Uranus's tropopause is 49 K (-224.2 °C; -371.5 °F), making Uranus the coldest planet in the Solar System.*

<sup>70</sup> Patrick Moore, *The Astronomy Encyclopaedia*, RD Press, 1987, p228

<sup>71</sup> [https://en.wikipedia.org/wiki/Moons\\_of\\_Uranus](https://en.wikipedia.org/wiki/Moons_of_Uranus)

<sup>72</sup> <https://en.wikipedia.org/wiki/Uranus>

The result is possibly a hot planet surface covered by an insulating blanket of cloud - similar to Venus but for very different reasons.

Planets Neptune, Saturn, and Jupiter are following the dynamic time scale similar to Earth's early history. See Section 23 RAB Diagrams.

### **Chapter 18. Interim Conclusions**

- 1) Uranus is slightly smaller than Neptune and had less internal heat. This resulted in a radial fracture of the protoplanet shell releasing internal pressure not aligned with the Sun, and consequently a unique solar orbit.
- 2) Solar radiation at Uranus and Neptune is comparatively weak, but the internal heat source at Neptune was sufficiently large to fracture that protoplanet surface in alignment with the Sun.
- 3) Uranus mass places the planet in the Mid Terrafirma Stage and undergoing Proto Continent formation, but this may be occurring in a disjointed way and not conducive to high mountain building.

## 19 NEPTUNE

This outer series of orbiting bodies - Neptune and 14 satellites, probably derived from the same solar proto dust cloud. Very weak solar radiation at this remote point provided little control over the location of the erupting planet face.

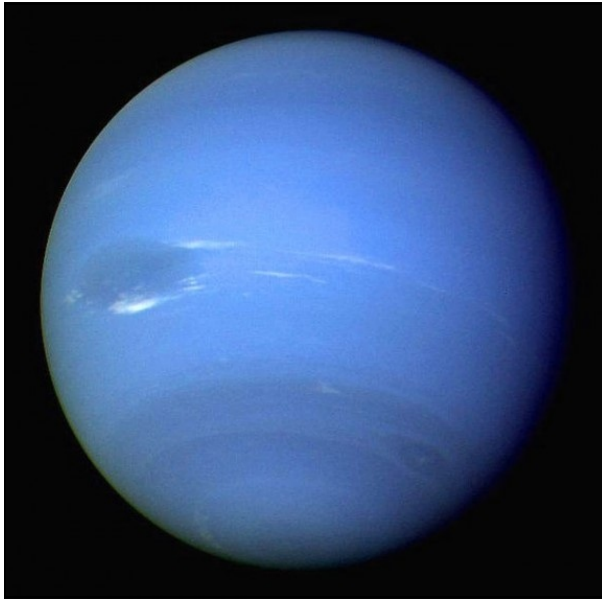


Figure 19.1 Neptune

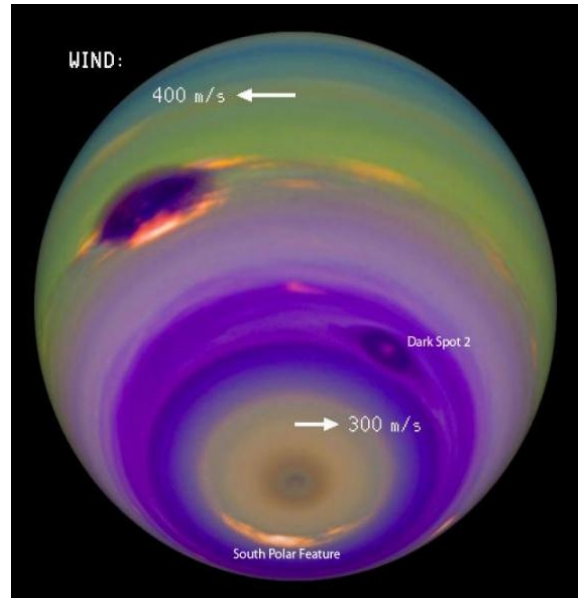


Figure 19.2 Neptune modified color/contrast image

Neptune has greater mass than Uranus with 17.2EMU (cw. 14.6EMU). Figure 19.2 shows more of the dark spot detail and the latitudinal variation and direction in wind speed.<sup>73</sup>

Greater mass is a larger energy source that appears to have produced two Eye spots—as observed originally in the 1989 Voyager II mission. The larger spot is near the equator, and a smaller about 50° from the equator. The pair of Eye spots may result from a surface split from the equator to one of the poles during Eye Stage activity - similar to Uranus. This was a precursor to satellite launch.

The larger equatorial Eye spot possibly projected the first satellite group into posigrade orbits.<sup>74</sup>

The smaller Eye spot could be the second satellite launch site which propelled those satellites into most eccentric orbits around Neptune.

*The moons of Neptune can be divided into two groups: regular and irregular. The first group includes the seven inner moons, which follow circular prograde orbits lying in the equatorial plane of Neptune. The second group consists of all other moons including Triton. They generally follow inclined eccentric and often retrograde orbits far from Neptune; the only exception is Triton, which orbits close to the planet following a circular orbit, though retrograde and inclined.*

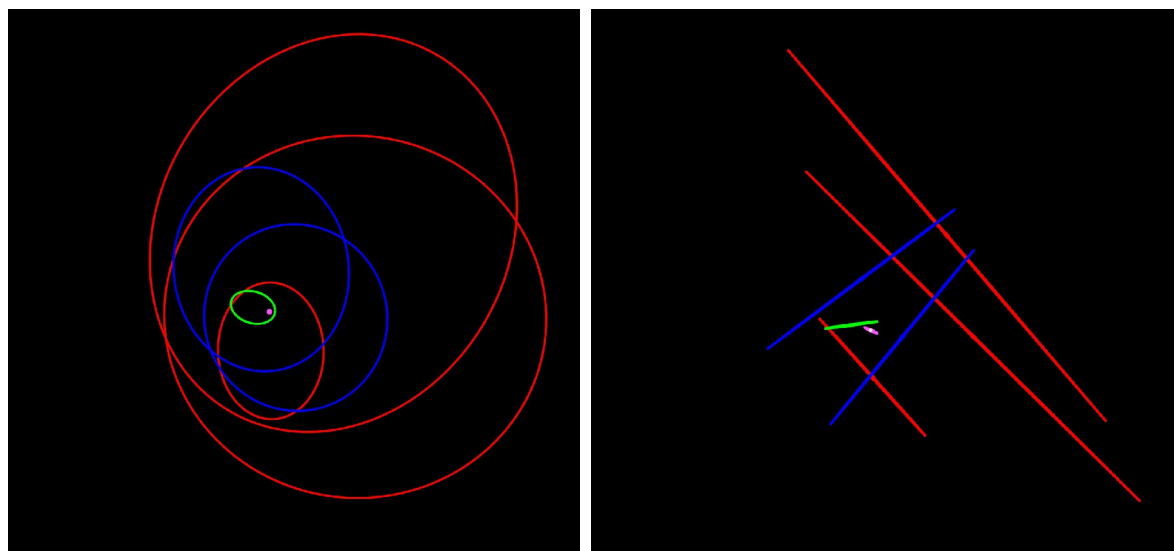
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<sup>73</sup> A modified color/contrast image emphasizing Neptune's atmospheric features, including wind speed. (Credit Erich Karkoschka)

<sup>74</sup> [https://en.wikipedia.org/wiki/Moons\\_of\\_Neptune](https://en.wikipedia.org/wiki/Moons_of_Neptune)

Neptunian moons - RETROGRADE ORBITS *										
Order	Label	Name	Diameter (km)	Mass (x10 <sup>16</sup> kg)	Semi-major axis (km)	Orbital period (d)	Orbital (°) inclination	Eccentricity	Year	Discoverer
<b>Regular moons</b>										
1	Neptune III	Naiad	66 (96x60x52)	~19	48 227	0.294	4.691	0.0003	1989	Voyager Science
2	Neptune IV	Thalassa	82 (108x100x52)	~35	50 074	0.311	0.135	0.0002	1989	Voyager Science
3	Neptune V	Despina	150 (180x148x128)	~210	52 526	0.335	0.068	0.0002	1989	Voyager Science
4	Neptune VI	Galatea	176 (204x184x144)	~375	61 953	0.429	0.034	0.0001	1989	Voyager Science
5	Neptune VII	Larissa	194 (216x204x168)	~495	73 548	0.555	0.205	0.0014	1981	Reitsema et al.
6	-	S/2004 N 1	~16-20	~0.5 ± 0.4	105 300 ± 50	0.936	0	0	2013	Showalter et al.
7	Neptune VIII	Proteus	420 (436x416x402)	~5035	117 646	1.122	0.075	0.0005	1989	Voyager Science
<b>Irregular Moons</b>										
8	Neptune I	<b>Triton</b> *	2 705 .2 ± 4.8	2 140 800 ± 5200	354 759	-5.877	156.865	0	1846	Lassell
9	Neptune II	Nereid	~340 ± 50	~2700	5 513 818	360.13	7.09	0.7507	1949	Kuiper
10	Neptune IX	Halimede *	~62	~16	16 611 000	-1 879 .08	112.898	0.2646	2002	Holman et al.
11	Neptune XI	Sao	~44	~6	22 228 000	2 912 .72	49.907	0.1365	2002	Holman et al.
12	Neptune XII	Laomedeia	~42	~5	23 567 000	3 171 .33	34.049	0.3969	2002	Holman et al.
13	Neptune X	Psamathe *	~40	~4	48 096 000	-9 074 .30	137.679	0.3809	2003	Sheppard et al.
14	Neptune XIII	Neso *	~60	~15	49 285 000	-9 740 .73	131.265	0.5714	2002	Holman et al.

Table 19.1 Neptune Satellite Statistics (after)<sup>75</sup>



Overhead or Top Down View

Side or Edge-on View<sup>76</sup>

Figure 19.3 Neptune Satellite Orbits

Figure 19.3 colours indicate:

Triton is the pink orbit nearest to Neptune, red orbits track Halimede, Psamathe and Neso - all retrograde.

Blue orbits track posigrade moons Sao and Laomedeia.

A subsequent deep inner core rupture under the equatorial vent may have placed the high density (2.066)<sup>77</sup> satellite Triton, into a highly angular and retrograde orbit. A thin atmosphere is present and Triton may have launched through a volatile atmosphere, following other eruptions. This was a late launch after the ejectile plume rotated outside the planet's solar orbiting path, and resulted in Triton capturing an atmosphere when it ejected. It follows a similar logic to that developed to explain the retrograde paths of the outermost Jupiter satellites (see Chapter 16 - Jupiter).

Residual ring structures (five faint ones) at Neptune are possibly Si-rich, and associated with a waning Projectile Stage of Dynamic Development. Alternately, they may be high density residual rings from the Eye Stage, with

<sup>75</sup> [https://en.wikipedia.org/wiki/Moons\\_of\\_Neptune](https://en.wikipedia.org/wiki/Moons_of_Neptune)

<sup>76</sup> <http://home.dtm.ciw.edu/users/sheppard/satellites/nepsatdata.html>

<sup>77</sup> [voyager.jpl.nasa.gov/science/neptune\\_triton.html](http://voyager.jpl.nasa.gov/science/neptune_triton.html)

the low density Projectile Stage rings already collapsed.

Eye activity associated with high level clouds (50-70km above the lower compact cloud mass), and the planet's mass, suggests Neptune is in its Mid Terrafirma Stage of development. Terrafirma associates with Proto Continent formation including high mountains surrounded by retreating lava lakes.

Primitive anaerobic life forms may exist in the high lake catchments, fed by torrential downpours and accompanied by massive erosion. This could be similar to conditions on Earth about 3.3 By ago, and should be located on the opposite side of the planet to the largest Eye spot.

Classic Dynamic Development at Neptune is further evidenced by Neptune, Saturn, and Jupiter being the only planets emitting significantly more heat than they receive from the Sun. Neptune's heat is coming from a rapidly condensing atmospheric cloud that is convecting core heat to outer space.

#### **Chapter 19. Interim Conclusions**

- 1) Both Uranus and Neptune appear to have suffered Eye stage fractures across the diameter of the planet. The main difference is the Equatorial vent was stronger at Neptune. At Uranus the polar vent was stronger.
- 2) Neptune is in its Mid Terrafirma Stage of development, which associates with Proto Continent formation including high mountains surrounded by retreating lava lakes. Primitive anaerobic life forms may exist in the high lake catchments.



## 20.1 KUIPER BELT<sup>78</sup>

The Kuiper belt /kaɪpər/ or Dutch pronunciation: [ˈkœy p r], sometimes called the Edgeworth–Kuiper belt, is a circumstellar disc in the Solar System beyond the planets, extending from the orbit of Neptune (at 30 AU) to approximately 50 AU from the Sun. It is similar to the asteroid belt, but it is far larger—20 times as wide and 20 to 200 times as massive. Like the asteroid belt, it consists mainly of small bodies, or remnants from the Solar System's formation. Although many asteroids are composed primarily of rock and metal, most Kuiper belt objects are composed largely of frozen volatiles (termed "ices"), such as methane, ammonia and water. The Kuiper belt is home to three officially recognized dwarf planets: Pluto, Haumea, and Makemake.

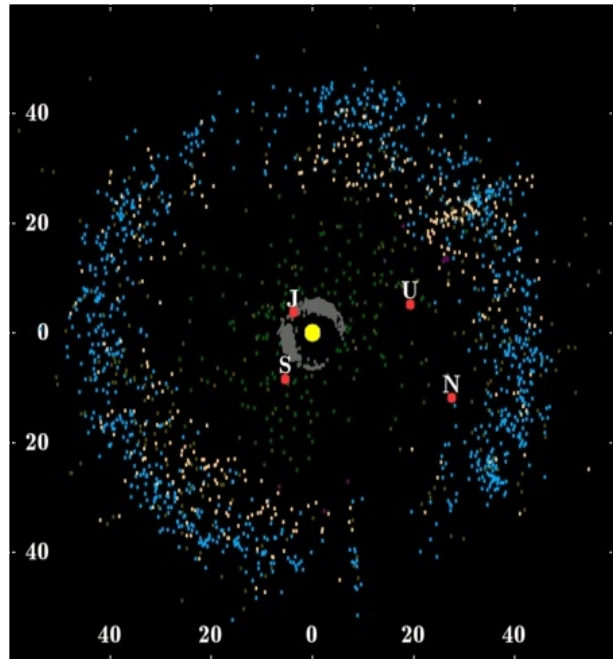


Figure 20.1 - Kuiper Belt

Figure 20.1 note “Known objects in the Kuiper belt beyond the orbit of Neptune. (Scale in AU; epoch as of January 2015.) Sun Jupiter trojans Giant planets: J · S · U · N Centaurs Kuiper belt Scattered disc Neptune trojans Distances but not sizes are to scale Source: Minor Planet Center, [www.cfeps.net](http://www.cfeps.net) and others”

*Despite its vast extent, the collective mass of the Kuiper belt is relatively low. The total mass is estimated to range between 1/25 and 1/10 the mass of the Earth.*

This treatise proposes that objects beyond Neptune are probably ejectile products from Jupiter and launched as shown in Figure 16.5 This defines them as ejectile material launched ahead of Jupiter’s sidereal orbit and therefore at escape velocity launch speeds additional to Jupiter’s orbiting speed. They have solar launch speeds up to 59.6 km/s plus 11.2 km/s, or 71.8 km/s.

The average required launch speed becomes 65.7 km/s. By considering KBOs as an extension of Jupiter, we can use the distance proportional ratio to deliver a Kuiper Belt orbiting velocity of 7.6 km/s. This is 1.7 times the orbiting speeds of some Kuiper Belt objects,<sup>79</sup> and indicates a degree of energy efficiency loss incurred in launching Jupiter based objects to the Kuiper Belt.

*Makemake (minor-planet designation 136472 Makemake) is a dwarf planet and perhaps the largest Kuiper belt, a ring of bodies beyond Neptune, object in the classical population, with a diameter approximately two thirds that of Pluto. Average orbital speed 4.419 km/s.*

<sup>78</sup> [https://en.wikipedia.org/wiki/Kuiper\\_belt](https://en.wikipedia.org/wiki/Kuiper_belt)

<sup>79</sup> <https://en.wikipedia.org/wiki/Makemake>



Pluto is also closely associated with the Kuiper Belt and known in more detail than Makemake. It is summarised in the following references.<sup>80</sup>



Figure 20.2 Full-disc view of Pluto in near-true color, imaged by New Horizons

*Pluto was discovered by Clyde Tombaugh in 1930 and was originally considered to be the ninth planet from the Sun. After 1992, its planethood was questioned following the discovery of several objects of similar size in the Kuiper belt. In 2005, Eris, which is 27% more massive than Pluto, was discovered*

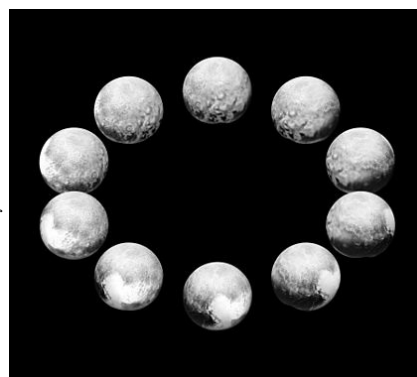


Figure 20.3 Mosaic of best-resolution images of Pluto from different angles

*Pluto has five known moons: Charon (the largest, with a diameter just over half that of Pluto), Styx, Nix, Kerberos, and Hydra. Pluto and Charon are sometimes considered a binary system because the barycenter of their orbits does not lie within either body.*



Figure 20.4 Family portrait of the five moons of Pluto, to scale

PLUTO SATELLITE - retrograde orbits *												
Name		a (km)	i (deg)	e	Peri (deg)	Node (deg)	M (deg)	Period (days)	mag	H (mag)	Size (km)	Year
P1*	Charon S/1978 P1	19591	0.08	0.0002	146.106	26.928	131.07	6.387	16.8	1	1207	1978
P5	Styx S/2012 P1	42393	0.08	0.0006	330.244	26.956	194.546	20.16	27		20	2012
P2	Nix S/2005 P2	48671	0	0	324.463	203.4	284.405	24.85	23.7		70	2005
P4	Kerberos S/2011 P1	57729	0.426	0	160.629	305.871	161.061	32.17	26		25	2011
P3	Hydra S/2005 P1	64698	0.304	0.0056	153.307	113.173	326.678	38.2	23.3		90	2005

Table 20.1 - Pluto Satellite Data - after<sup>81</sup>

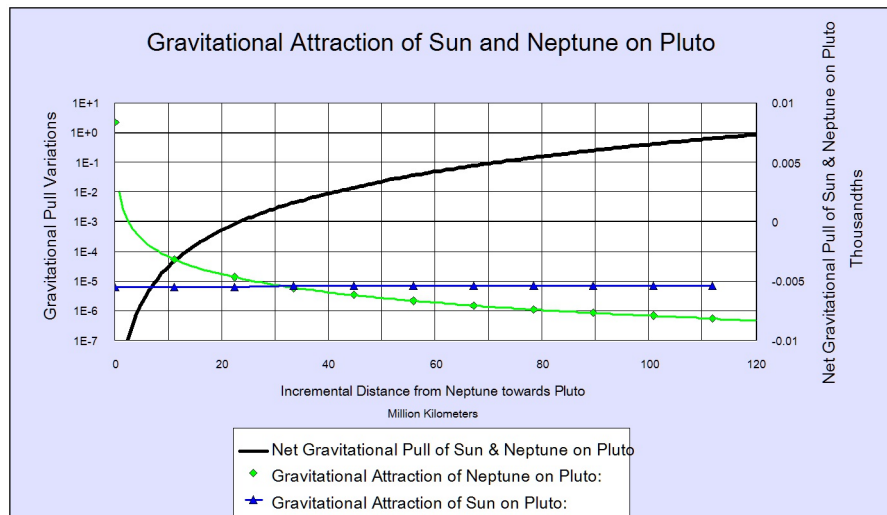
a - The mean semi-major axis.  
i - The mean inclination.  
e - The mean eccentricity.  
Peri - The argument of Periaphis.  
Node - The longitude of the ascending node.  
M - The mean anomaly.  
Period - The time of one revolution around Neptune.  
mag - The optical magnitude of the object (R-band).  
H - The absolute magnitude of the object.  
Size - The diameter of the object.  
Year - The year of discovery.

Pluto is close to, and tidally locked with its main satellite Charon. It sits well below Critical Planet Mass. See Chapter 5 - Critical Planet Mass. It could be a late stage launch satellite from Neptune, but more probably came from Jupiter. See Figure 16.5

Pluto's highly eccentric orbit passes inside Neptune's orbit at one point. This leaves open the possibility that Pluto launched towards the Sun at more than the escape velocity of Neptune, and past the nil gravity field, some 34 million kilometers out as shown in Graph 20.1 The residual sidereal momentum from Neptune carried Pluto into a Sun orbit - together with Pluto's associated satellites.

<sup>80</sup> <https://en.wikipedia.org/wiki/Pluto>

<sup>81</sup> <http://home.dtm.ciw.edu/users/sheppard/satellites/plutosatdata.html>



Graph 20.1 Gravitational Attraction of Neptune on Pluto

There remain three feasible launch methods:

1. Pluto with satellites, launched at early Eye Stage and consist of low density outer planet shell material combined with some associated ejection gases. This option strengthens if there is evidence of an asteroid belt orbiting between Neptune and Uranus. Asteroids 944 Hidalgo and 2060 Chiron provide some evidence to this effect.<sup>82</sup>
2. Alternatively, Pluto with satellites launched during the Projectile Stage of Neptune's development about 300 million years ago. In this case, they consist of siliceous and volatile material ejected by Kinetic Pipe activity.
3. A late stage ejection from Jupiter as the Eye position allowed for satellite launch into a higher solar orbit, is considered the most likely, as per Figure 16.5

The third option is considered in more detail:

Chapter 8 shows the potential for large quantities of heat energy to be stored below a solid outer shell. Potential heat energy increases with depth and pressure which forms a series of phase change environments inherent to the various mineral assemblages. When the outer shell bursts as indicated in Chapter 3, there follows a series of pressure releases as mineral phase changes occur under reducing pressure conditions. This can be regarded as an onion ring structure. Large planets are expected to have more internal layers than smaller planets. Assuming Jupiter originated from a dust cloud, and initially had a hard outer shell, this largest of planets would have had several internal layers that exploded progressively while the planet completed its first solar (axial) orbit.

<sup>82</sup> Abell, Morrison, Wolff. *Exploration of the Universe*, CBS College Publishing, 5th Ed.1987, p378

## 20.2 OORT CLOUD

As the ejectile plume from Jupiter passes back towards the Sun, projectiles delivered in this rotational phase point towards the Sun as shown in Figure 20.5

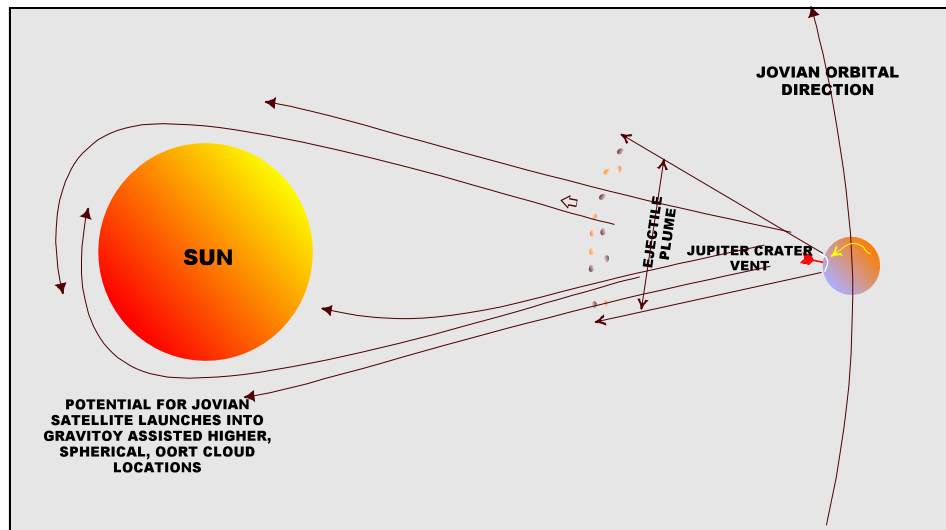


Figure 20.5 - Oort Cloud Formation

*The Kuiper belt should not be confused with the theorized Oort cloud, which is a thousand times more distant and is **mostly spherical**. The objects within the Kuiper belt, together with the members of the scattered disc and any potential Hills cloud or Oort cloud objects, are collectively referred to as trans-Neptunian objects (TNOs).*<sup>83</sup>

The Oort Cloud is seen as mostly spherical, it apparently has a different origin to other objects populating the Solar System ellipsoid plane. Figure 20.5 illustrates a possible mechanism capable of forming a distant spherical cloud. Many objects ejected from Jupiter towards the Sun in a 3D spray pattern would combine with the Sun, while some would miss the Sun's edge and gain a gravitational sling shot advantage capable of placing them into a high spherical orbit, and outside the Kuiper Belt radius. Objects in the Oort Cloud could include comets and meteors which have orbits consistent with Oort Cloud origins.

Launch speed from Jupiter could be in excess of 71.8 km/s. This would imply orbiting speeds at the Oort Cloud are in the order of 7.5 mps, and given that a gravity assist component could compensate for the energy efficiency loss incurred in launching Jupiter based objects to the Oort Cloud.

Unfortunately, all the current probes heading towards the Oort Cloud will be inoperative when they arrive.<sup>84</sup>

<sup>83</sup> [https://en.wikipedia.org/wiki/Kuiper\\_belt](https://en.wikipedia.org/wiki/Kuiper_belt)

<sup>84</sup> <http://www.universetoday.com/32522/oort-cloud/>

## **Chapter 20. Interim Conclusion**

- 1) This treatise proposes that Kuiper Belt and Oort Cloud objects originated from Jupiter, and were delivered during the first solar orbit of Jupiter when Eye activity was at its most explosive.
- 2) Estimated Kuiper Belt orbiting velocity of 7.6 km/s is 1.7 times the orbiting speeds of some Kuiper Belt objects, and indicates a degree of energy efficiency loss incurred in launching Jupiter based objects to the Kuiper Belt.
- 3) Implied orbiting speeds at the Oort Cloud are in the order of 7.5 mps (0.0075 km/s), and appears reasonable given that a gravity assist component would compensate for the energy efficiency loss incurred in launching Jupiter based objects to the Oort Cloud.

Previous work suggests the Earth's temperature, at 10 km depth, has dropped from 500°C in the Archean to 430°C now.<sup>85</sup> Other work suggests a quicker time/temperature relationship<sup>86</sup> starting from a higher base temperature 750°C, and finishing at 521°C. The latter relationship is more consistent with this treatise and can be expressed in mathematical terms as:

$$\text{Time (My)} = 8347 \times \ln(T^{\circ}) - 52215 \quad -21.1$$

Where time is in millions of years before the present, and T° is temperature in the upper mantel.

The temperature gradient from the surface is in the order of 37°C/km depth and is unaffected by small reductions in mantel temperature. If the current average surface temperature is 25°C, it will take a further 409 My. to reduce this temperature to 0°C. Reducing surface temperature 5°C from 25°C to 20°C will take another 79 My.

These conclusions presuppose the rates of cooling will not alter. It is more probable that continued cooling will result in significantly less atmospheric moisture. This leads to an accelerated rate of radiated heat loss from the surface, and an increase in the geothermal gradient under Continental regions. The 20°C surface temperature figure could arrive in 40 My or less, and be accompanied by widespread icing.

A further consideration is whether the Earth is expanding through Gravimass accumulation.<sup>87</sup> Increased mass may include additional radioactive elements which would reduce the rate of global cooling.

### **Chapter 21. Interim Conclusions**

- 1) Geological records show Earth is colder now than it was in past eras. This is due to reducing nuclear activity at the core.
- 2) The rate of Earth cooling shows the surface is heading for a general icing in 409 My.
- 3) A contributing factor in reducing the rate of Earth cooling may be the introduction of Gravimass material which includes radioactive elements.

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<sup>85</sup> G.J.H McCall, *The Archean-Searching for the Beginning*, Dowden, Hutchinson & Ross Inc. Penn, USA, 1977. p459

<sup>86</sup> Kent C. Condie, *Archean Greenstone Belts*, Elsevier Scientific Pub. Coy. 1981. p319, after Wynn-Edwards, 1976)

<sup>87</sup> [www.bosmin.com/PSL/GRAVIMASS.pdf](http://www.bosmin.com/PSL/GRAVIMASS.pdf)

Previous planet stages are in a Time/Activity diagram that incorporates the major Dynamic Geological Time Scale elements. See Figure 22.1 - RAB Diagram 1. RAB Diagram 1 shows the evolutionary cycle for planets of Super Critical Mass. See Chapter 5 - Critical Mass. Because planets cool at different rates, we can compare previous stages of dynamic development on Earth with conditions existing at the larger planets today. See Chapter 12 - Dynamic Geological Time Scale.

The different line slopes may indicate that larger planets are considerably older than the smaller planets, where the accretion time is longer. The extension trends (dashed lines) shown in Figure 22.1 indicate the solar planetary system may be 2.2 to 2.3 billion years older than currently reported.

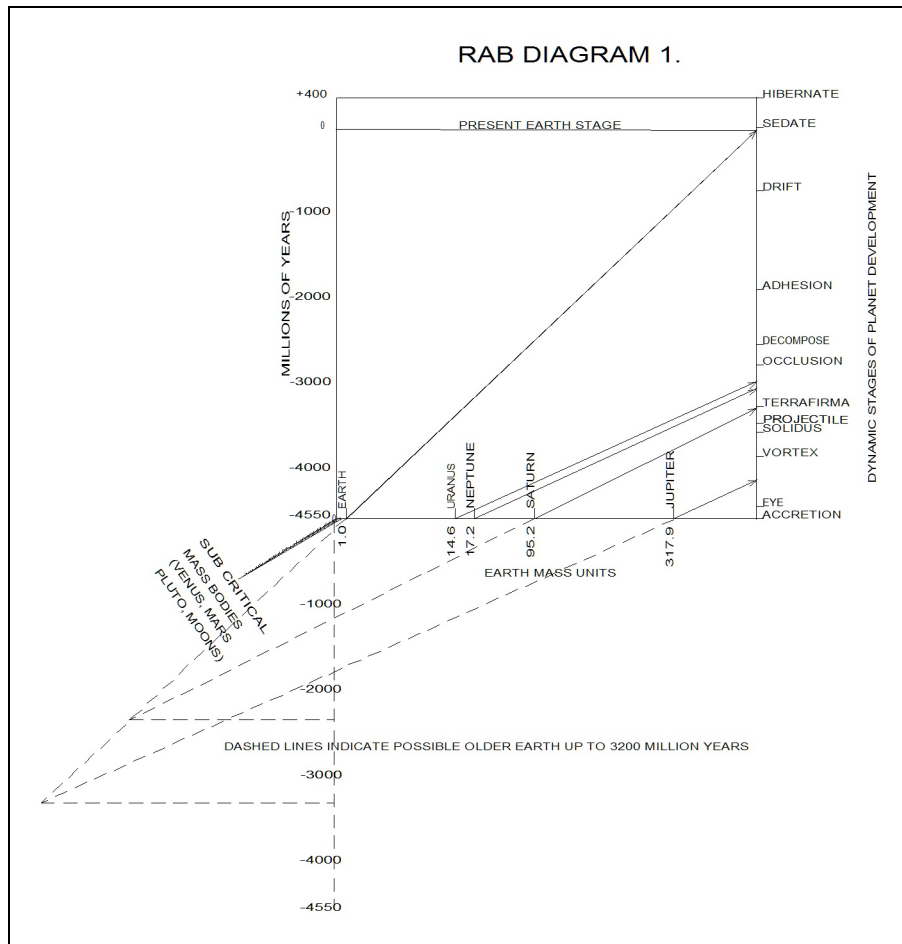


Figure 22.1 - Planet Mass vs Dynamic Development Stages

Following the development of radiometric age-dating in the early 20th century, measurements of lead in uranium-rich minerals showed that some were in excess of a billion years old. The oldest such minerals analyzed to date—small crystals of zircon from the Jack Hills of Western Australia—are at least 4.404 billion years old. Comparing the mass and luminosity of the Sun to those of other stars, it appears that the Solar System cannot be much older than those rocks. Calcium-aluminum-rich inclusions—the oldest known solid constituents within meteorites that are formed within the Solar System—are 4.567 billion years old, giving an age for the Solar System and an upper limit for the age of Earth.<sup>88</sup>

<sup>88</sup> [https://en.wikipedia.org/wiki/Age\\_of\\_the\\_Earth](https://en.wikipedia.org/wiki/Age_of_the_Earth)

Similar conclusions may be drawn as to the likelihood of life forms or geological stages of development at other planetary systems surrounding stars of differing ages to the Sun. These possibilities show in Figure 22.2 - RAB Diagram 2.

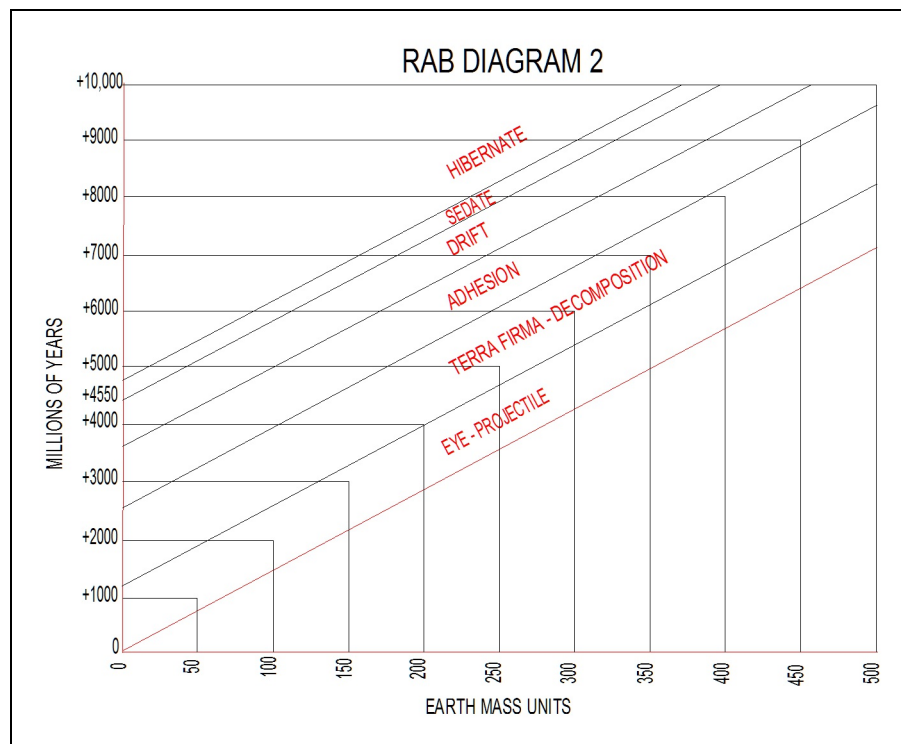


Figure 22.2 - Planet Dynamic Development Stages vs Star Ages

## Chapter 22. Interim Conclusions

- 1) RAB Diagrams provide a useful tool for comparing Dynamic Stages of development at other Solar System Planets as well as predicting development stages at planets orbiting in other Solar Systems.
- 2) The age of the Earth is derived from zircon crystals entrained in various ancient rock types. However, the crystals do not record earlier time periods when Earth's surface may have been in complete meltdown. There remains a possibility that Earth is much older than currently envisaged.

23  
*CONCLUSIONS*

- 1.1 This treatise adds several dimensions to astrophysics and geology.
- 2.1 The larger the planet, the larger is the solar angular momentum and the number of satellites launched.
- 2.2 Sidereal revolving motion is primeval and reflects the angular momentum of the system's proto cloud. Solar rotation is subsequently acquired, and is predominantly associated with the formation of satellite/s.
- 2.3 The further a planet or satellite is from the Sun, the more distorted its rotations and satellite orbits are likely to be.
- 3.1 The Sun's rays on the solar side of the Earth, before lunar separation occurred, was a critical external heating event in the Earth's history.
- 3.2 Internal sources of planet heat associated with convection are the most significant tectonic motivating forces in the post lunar separation period.
- 4.1 A Sun's constant radiation on one face of a protoplanet in tidal lock with the Sun has the potential to cause an eruption capable of launching satellites from the protoplanet, and imparting solar rotation to the planet.
- 4.2 Planets Uranus and Neptune are far enough away from the Sun to exhibit unusual solar and satellite orbiting sequences.
- 5.1 Earth is the smallest planet with sufficient inherent energy to launch satellites.
- 6.1 The Moon's highland surface represents how the Earth's surface used to be.
- 6.2 The lunar mare areas are limited volcanic lakes formed after the Moon separated, and before all the heat supplied by the Earth had diminished. Some are the result of meteor impact penetrating the thin crust and into the molten magma layer.
- 6.3 Gravitational attraction to the Earth pulled higher density magma material to the Moon's near surface, while the Moon was still in a fairly plastic state.
- 7.1 The Earth's heat content during the Archean was sufficient to launch satellites at orbiting and escape velocities.
- 7.2 Subsequent periods included Diamond Pipe formation. See Chapter 10 - Kinetic Pipes, which liberated sufficient energy to launch projectiles into orbit, and deposited diamondiferous material near Earth's surface.
- 7.3 Currently, volcanic chambers with roots deeper than 80km have sufficient energy to launch orbiting satellites.
- 8.1 The Moon's surface represents how the Earth's surface was before the internal volatiles burst through the outer shell.
- 8.2 Solar rotation and elliptical sidereal rotation were provided to the Earth during the Moon launch.
- 8.3 Mercury launched from the Earth into a sidereal orbit shortly after the Moon launch at speed in excess of the escape velocity between 11.18 and 18.25 km/sec.
- 9.1 A Protocontinent develops through elutriation of lava flowing from the Eye to the opposite side of the globe where a Vortex forms.
- 9.2 Condensation of the giant cloud only occurs when a high landmass develops above the Vortex site.
- 10.1 Much of the ejected material from Kinetic Pipes can reach and exceed planet orbiting speeds.
- 10.2 Silica rich meteorites originate from Kinetic Pipe activity, while iron rich asteroids are more likely to come from Eye spot vents.
- 10.3 Kinetic Pipe material forms the classic ice and rock ring structures surrounding Saturn, and is possibly the origin for some low density smaller satellites. Ice and/or rock rings are present, to a waning extent at other outer giant planets. This implies that ejection mechanisms have universal application with planets of Super Critical Mass. The Vortex stage of activity on Earth peaked over one billion years from -3500my to -2550my. Kinetic Pipe activity continued much longer, but at a considerably reduced level.
- 11.1 Widespread earthquake activity signals renewed plate movement, core heat release, warmer seas, higher levels of atmospheric carbon dioxide, increased humidity, more rainfall, a buildup of snow on the world's icefields, and advancing glaciers.
- 11.2 The long term trend, beyond solar variations, is for reduced global geothermal activity. Periods of lower humidity will increase with time, and Ice Ages, as we know them will become less frequent.
- 11.3 Ice forming on a cooling planet is low energy ice and forms at sea level as opposed to high energy ice evident in mountain top glaciers.
- 12.1 Many of early Earth geological periods appear to be associated with particular dynamic phases that lasted through eras, before being replaced with new sets of dynamics.
- 12.2 Early geological events known to have occurred on Earth show a remarkable parallel to events which

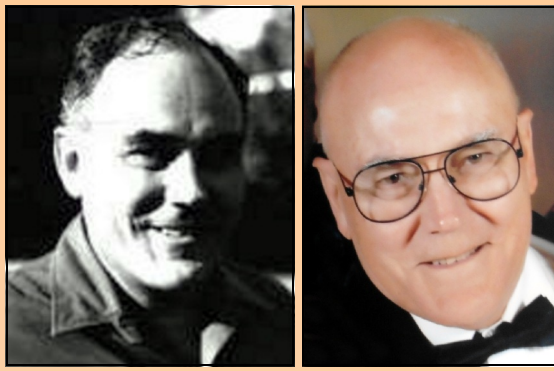


- appear to be happening on other Solar System planets.
- 12.3 The time displacements of events between Earth and other Solar System planets appears to relate to the differences in planet mass.
  - 13.1 Planets Venus, Earth, Jupiter, Saturn, Uranus, and Neptune appear to be six original solar orbiting bodies, while other Solar System objects have subsequently evolved as orbiting objects.
  - 14.1 This treatise concludes that the most plausible origin for Mercury is a late launch from Earth immediately following the Moon launch, at a velocity of up to 18.25 mps.
  - 14.2 Venus is too close to the Sun and of insufficient mass to form a normal planet and moon system. The result is Venus is in near tidal lock with the Sun, and similar to the original proto cloud sidereal orbit.
  - 14.3 Earth was just above Sub Critical Size and far enough from the Sun to prevent premature release of satellite launch volatiles. The result is a planet further advanced along the Dynamic Stages of Development, than any other of the Solar System planets. Currently, Earth is in the Drift Stage.
  - 15.1 Both Mars and the Asteroid Belt could have launched from Jupiter in a violent eruption during the early Eye Stage of the planet development.
  - 15.2 The great mass of Jupiter may be expected to completely dominate early eruption activity in the Solar System.
  - 16.1 Jupiter radiates 2.7 times more heat than it receives from the Sun which shows it has a substantial energy source coming from within.
  - 16.2 The rate of energy release from Jupiter today can be expected to be considerably less than it was in Archaean times. This means that Jupiter provided the most violent contributions to the formation of the Solar System as a whole, and only surpassed by the Sun.
  - 16.3 Jupiter provided sufficient energy to launch Mars, the Asteroid Belt, Moons of Jupiter, the Kuiper and Oort Cloud objects.
  - 17.1 Saturn is the most dramatic ring display planet in the Solar System.
  - 17.2 Saturn is probably in Mid-Late Projectile Stage (equal to 3.3B.y. ago on Earth).
  - 17.3 The ring structure is launched from Saturn in an ongoing series of eruptions, and Hyperion provides tangible details of how this material originates.
  - 18.1 Uranus is slightly smaller than Neptune and had less internal heat. This resulted in a radial fracture of the protoplanet shell releasing internal pressure not aligned with the Sun, and consequently a unique solar orbit.
  - 18.2 Solar radiation at Uranus and Neptune is comparatively weak, but the internal heat source at Neptune was sufficiently large to fracture that protoplanet surface in alignment with the Sun.
  - 18.3 Uranus mass places the planet in the Mid Terraforma Stage and undergoing Proto Continent formation, but this may be occurring in a disjointed way and not conducive to high mountain building.
  - 19.1 Both Uranus and Neptune appear to have suffered Eye stage fractures across the diameter of the planet. The main difference is the equatorial vent was stronger at Neptune. At Uranus the polar vent was stronger.
  - 19.2 Neptune is in its Mid Terraforma Stage of development, which associates with Proto Continent formation including high mountains surrounded by retreating lava lakes. Primitive anaerobic life forms may exist in the high lake catchments.
  - 20.1 This treatise proposes that Kuiper Belt and Oort Cloud objects originated from Jupiter, and were delivered during the first solar orbit of Jupiter when Eye activity was at its most explosive.
  - 20.2 Estimated Kuiper Belt orbiting velocity of 7.6 km/s is 1.7 times the orbiting speeds of some Kuiper Belt objects, and indicates a degree of energy efficiency loss incurred in launching Jupiter based objects to the Kuiper Belt.
  - 20.3 Implied orbiting speeds at the Oort Cloud are in the order of 7.5 mps (0.0075 km/s), and appears reasonable given that a gravity assist component would compensate for the energy efficiency loss incurred in launching Jupiter based objects to the Oort Cloud.
  - 21.1 Geological records show Earth is colder now than it was in past eras. This is due to reducing nuclear activity at the core.
  - 21.2 The rate of Earth cooling shows the surface is heading for a general icing in 409 My.
  - 21.3 A contributing factor in reducing the rate of Earth cooling may be the introduction of Gravimass material which includes radio active elements.
  - 22.1 RAB Diagrams provide a useful tool for comparing Dynamic Stages of development at other Solar System Planets as well as predicting development stages at planets orbiting in other Solar Systems.
  - 22.2 The age of the Earth is derived from zircon crystals entrained in various ancient rock types. However, the crystals do not record earlier time periods when Earth's surface may have been in complete meltdown. There remains a possibility that Earth is much older than currently envisaged.

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Author circa 1985 and 2017

Bob Beatty is an Australian Mining Engineer, with a reputation for innovative mining processes, and is the registered inventor of seven mining related patents.

In the mid '80s he became sceptical over claims that the Moon launched from the Earth in a violent collision involving an incoming heavenly body. Scepticism arose from the lack of universal application for this theory - particularly at planets where some satellites orbit in the opposite direction.

Bob decided there must be a logical answer based on physics and engineering theory. The search started in a re-appraisal of the LaPlacian model of the Solar System, lasted ten years, and resulted in publishing the first edition of Planets Satellites and Landforms. A second edition of Planets, Satellites and Landforms is now completed, after some 30 years of investigation, during which time giant steps have occurred in space exploration.

A fascinating journey of discovery led to other possibly answers to some of our oldest geoscience conundrums including:

- ☐ Where did the Moon come from?
- ☐ Why do the outer satellites of Jupiter (and other planets) orbit in a retrograde direction?
- ☐ Are Mercury, Mars and Pluto true planets or solar orbiting satellites?
- ☐ What part did Jupiter play in the formation of our Solar System?
- ☐ What is the mechanism for the ring formation on Saturn?
- ☐ How did the Kuiper Belt and Oort Cloud form?
- ☐ Where do comets come from?
- ☐ Why did the continents on Earth drift from one location, and where was it?
- ☐ What do diamond pipes represent?
- ☐ Which planets are most likely to have life forms similar to Earth's?
- ☐ Are retreating glaciers associated with 'global warming'?
- ☐ Why do Ice Ages occur?

The work draws parallels between previous stages of Dynamic Development on Earth and those currently occurring at the larger planets.

This treatise suggests a Universal Dynamic Stage Development Sequence for all planets of "Super Critical Mass" summarised in RAB Diagrams 1. & 2.