THE IONIC GROWING EARTH©
A Mass and Entropy Theory
For an Expanding Earth in an Expanding Universe

By Eugene A. Ellis (Oct. 2014)

Comprehensible evidence exists today that the energy degradation (decay) which occurs over geological time is the remnant of energy that converted to matter and entropy (heat). The decay of five elements (O, Fe, Si, Mg, and S), as exemplified by their ionization properties, is responsible for the Earth accumulating sufficient mass to double its radius at least **twice** in the past billion years. Before that time, the converted energy from the same five elements internally heated a super cold planet for several billion years and afterwards, provided sufficient heat to help maintain a fairly temperate environment to support life while exponentially growing to its present size. It is responsible for the oxygen in water doubling 7 times in mass and volume for a 128 fold increase to incrementally fill the growing ocean beds created during the crustal expansions of past 180 to 200 million years.

The evidence started a century ago with Niels Bohr presenting a model to view atomic particles and of the radiation emanating from them that eventually won the Nobel Prize in Physics in 1922. The model provides elemental atoms displaying discrete energies that are associated with orbits, and radiation emitted in specific frequencies whenever the electrons move or "jump" from a higher energy level to a lower energy level. The model led to a search for the origin or the disposition of those discrete energies.

Energy level data was compiled in 1970 by Charlotte E. Moore; NBS-34, Ionization Potentials and Ionization Limits Derived from the Analysis of Optical Spectra. The defined ionization potential of an element is a measure of its ability to enter chemical reactions requiring ion formation or donation of electrons and is related to the nature of the chemical bonding in compounds formed by elements. Ionization, however, encompasses more than this definition. Table 1 on page 2 is highlighted and noted to express meanings as used herein. The table lists energy level potentials and limits in electron volts that correspond to the electron activity of the atoms. One electron volt (1eV) is the amount of energy an electron gains moving through a potential of one volt in a vacuum. For each element, the largest number in the row is the ionization limit and it marks the first time the element is able to enter a reaction or bond. Prior to the time of this first ionization, the element is neutral and its atoms would reflect that neutrality. Noting the energy degradation, decay, from the time an element first ionizes to the weaker ground states listed in Column I, one could extract meanings concerning geological time. By allowing an energy decay of 1 electron volt every 1.75 million years, a geological time scale can be constructed revealing when an element ionizes for the first time and for each successive potential. Originally, this paper allowed a decay rate of 1 eV per 2 million years and provided graphs, charts and narrative indicating the energy of decay was converting to mass and heat within the atoms of the elements. Reasonable connections were made with many geological events occurring about 25 million years before a boundary that separates the periods between the present to 540 MYA.

TABLE 1

NBS-34 Table 1, pages 2 and 3 -Ionization Potentials and Limits (in eV) (First 30 Elements only)

Z	Element	Spectrum																				Z
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	
1	H	13.598																					1
2	He	24.587	54.416																				2
3	Li	5.392	75.638	122.451																			3
4	Be	9.322	18.211	153.893	217.713																		4
5	B	8.298	25.154	37.93	259.368	340.217																	5
6	C	11.26	24.383	47.887	64.492	392.077	489.981																6
7	N	14.534	29.601	47.448	77.472	97.888	522.057	667.029															7
8	O	13.618	35.116	54.934	77.412	113.896	138.116	739.315	871.387														8
9	F	17.422	34.97	62.707	87.138	114.24	157.161	185.182	953.886	1103.09													9
10	Ne	21.564	40.962	63.45	97.11	126.21	157.93	207.27	239.09	1195.8	1362.16												10
11	Na	5.139	47.286	71.64	98.91	138.39	172.15	208.47	264.18	299.87	1465.09	1648.66											11
12	Mg	7.646	15.035	80.143	109.24	141.26	186.5	224.94	265.9	327.95	367.53	1761.8	1962.61										12
13	Al	5.986	18.828	28.447	119.99	153.71	190.47	241.43	284.59	330.21	398.57	442.07	2085.98	2304.08									13
14	Si	8.151	16.345	33.492	45.141	166.77	205.05	246.52	303.17	351.1	401.43	476.06	523.5	2437.68	2673.11								14
15	P	10.486	19.725	30.18	51.37	65.023	220.43	263.22	309.41	371.73	424.5	479.57	560.41	611.85	2816.94	3069.76							15
16	S	13.36	23.33	34.83	47.3	72.68	89.049	280.93	328.23	379.1	447.09	504.78	564.65	651.63	707.14	3223.84	3494.1						16
17	Cl	12.967	23.81	39.61	53.46	67.8	97.03	114.193	348.28	400.05	455.62	529.26	591.97	656.69	749.74	809.39	3658.43	3946.19					17
18	Ar	15.759	27.629	40.74	59.81	75.02	91.007	124.319	143.456	422.44	478.68	538.95	618.24	686.09	755.73	854.75	918	4120.78	4426.11				18
19	K	4.341	31.625	45.72	60.91	82.66	100	117.56	154.86	175.814	503.44	564.13	292.09	714.02	787.13	861.77	968	1034	4610.96	4933.93			19
20	Ca	6.113	11.871	50.908	67.1	84.41	108.78	127.7	147.24	188.54	211.27	591.25	656.39	726.03	816.61	895.12	947	1087	1157	5129.05	5469.74		20
21	Se	6.54	12.8	24.76	73.47	91.66	111.1	138	158.7	180.02	225.32	249.832	685.89	755.47	829.79	926							21
22	Ti	6.82	13.58	27.491	43.266	99.22	119.36	140.8	168.5	193.2	215.91	265.23	291.497	787.33	861.33	940.36							22
23	V	6.74	14.65	29.31	46.707	65.23	128.12	150.17	173.7	205.8	230.5	255.04	308.25	336.267	895.58	974.02							23
24	Cr	6.766	16.5	30.96	49.1	69.3	90.56	161.1	184.7	209.3	244.4	270.8	298	355	384.3	1010.64							24
25	Mn	7.435	15.64	33.667	51.2	72.4	95	119.27	196.46	221.8	243.3	286	314.4	343.6	404	435.3	1136.2						25
26	Fe	7.87	16.18	30.651	54.8	75	99	125	151.06	235.04	262.1	290.4	330.8	361	392.2	457	489.5	1266.1					26
27	Co	7.86	17.06	33.5	51.3	79.5	102	129	157	186.13	276	305	336	379	411	444	512	546.8	1403				27
28	Ni	7.635	18.168	34.17	54.9	75.5	108	133	162	193	224.5	321.2	352	384	430	464	499	571	607.2	1547			28
29	Cu	7.726	20.292	36.83	55.2	49.9	103	139	166	199	232	266	368.8	401	435	484	520	557	633	671	1698		29
30	Zn	9.394	17.964	39.722	59.4	82.6	108	134	174	203	238	274	310.8	491.7	454	490	542	579	619	698	738	1856	30

NOTES: *©2013*

1) The ionization potentials are in electron volts (eV) for each spectrum.
2) The elements are arranged in order of increasing atomic numbers, Z.
3) The successive stages of ionization are indicated at the heading of each column: I, denoting the first spectra (neutral atoms); II, second spectra (single ionized atoms}, etc.
4) The amount of energy required to remove a single electron is based upon an ambient energy level the planet is experiencing at the present time. A billion years ago, that ambient level would have been very much higher.
5) Viewing the table, those higher energy levels would have been the time in the past the element ionizes. The highest limit, therefore would be the time an element first ionizes in a higher ambient.
6) Multiplying any level in Table 1 by 1.75 produces the time of that level, e.g. oxygen was first able to bond at level VIII 1,524 MYA (1.75 x 871.387).
7) An anomaly surfaces when small incremental jumps of energy suddenly a become large jump as highlighted. See Table 3 and Figures 1 &2 for the 5 elements of concern.

Geologist claim these divide lines indicate where the nature of the fossil records change drastically, with the greatest changes occurring at the boundaries separating the Cambrian, the Paleozoic, the Mesozoic, and the Cenozoic Eras.

Using the decay rate of 1 eV/1.75 MY and the largest number in Table 1, the first element to ionize was calcium roughly 10 billion years ago (1.75 x 5469.738 eV). Likewise, oxygen's first two ionizations appeared ~1.5 and 1.3 billion years ago and thus became capable of chemically bonding with hydrogen to form the hydroxide ion and water. Theoretically, water first appeared on Earth around that time. Geologically, significant free oxygen appeared in the atmosphere 1.7 to 1.8 billion years ago. This geological factoid confirms a rational decay rate of 1 electron volt every 1.75 million years and questions the notion of water being on the planet from its beginning +4.5 billion years ago.

The law of conservation of energy is a law of Physics that states the total amount of energy in a system remains constant over time. Decay does not mean voltage energy was lost or destroyed. Here it implies an equivalent increase in mass is necessary to balance the energy deficit of 1eV every 1.75 million years. If one adds the equivalent mass of decay to the atoms, then the time for an element to double its mass could be determined. One eV per 1.75 million years is equivalent to 1.073544 or 0.6134537 mass units per million years. Therefore, it would take oxygen, by dividing its atomic mass of 15.9994 by 0.6134537, ~26 million years to double. Likewise it would take iron ~91 million years, silicon ~46 million years, magnesium ~40 million years, aluminum ~44 million years, and sulfur ~52 million years. If the atomic masses of the past are proportionally less than the present, then the time for each element to double its mass would remain the same.

The six elements in Table 1 are designated because these elements are said to comprise over 90% of the Earth's matter; five for the mantle/crust and five for the total Earth. The upper mantle/crust percentages are applicable of matter involved in the National Oceanic and Atmospheric Association (NOAA) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) oceanic and continental shelf expansions. The amounts and doubling effects of these elements are:

TABLE 2 MASS DOUBLING RATES (Energy = Mass) *©2013*

	Elemental		Total Earth			Mantle/Crust	
	Atomic Mass	Rate (MY)	Percentages	Rate (MY)	100 MY Rate/eV *	Percentages	Rate (MY)
O	15.9994	26.08	30.10%	7.85	2.01968	46.71%	12.182
Fe	55.8470	91.04	32.10%	29.22	0.61706	5.50%	5.007
Si	28.0855	45.78	15.10%	6.91	0.57718	27.69%	12.677
Mg	24.3050	39.62	13.10%	5.19	0.57862	2.08%	0.824
Al	26.9815	43.98	---	---	---	8.07%	3.549
S	32.0600	52.26	2.90%	1.52	0.09711	---	---
Totals			93.30%	50.69	3.88965	90.05%	34.240
			100.00%	54.33		100.00%	38.023
* Rate/1.75MY = Rate/eV			Use	54.17	3.59375		

The mantle/crust data included in the table indicates that much of the oxygen expansion in the crust occurs in the water molecules. Water is expanding at a ~26 million year rate while the rest of the crust is expanding at a slower rate, dependent upon how much oxygen is bonded to the other elements. Therefore, the expanding water is not only filling the growing ocean floors but appears to be doing so at a rate greater than the crust is expanding. There has been no other numerical explanation of how and why the water increases on an expanding Earth.

By multiplying the atomic mass doubling rate of each element by its percentage of total Earth reveals the Earth's mass is presently doubling around every 54.17 million years. Such doublings indicate exponential growth and the equation for a 54.17 million year rate of doubling is of the order, $f(x) = 3.59375^x$. Since the mass is growing exponentially, it follows the volume must also be expanding exponentially. James Maxlow teaches on his website (JamesMaxlow.com) an exponentially expanding Earth in "Global Expansion Tectonics" and in his book, Terra Non Firma Earth (Oneoff Publishing, 2005). Reduced surface gravity in the past is necessary per Stephen Hurrell's extended abstract "Ancient Life's Gravity and its Implications for the Expanding Earth" (Book p.31, 2011) and his book, Dinosaurs and the Expanding Earth (Oneoff Publishing, 2011). A 50% reduction in surface gravity during the Triassic (210-250 MYA) is thought to be essential for dinosaurs to have existed. The equation for surface gravity is $g = G M / r^2$, where G is the gravitational constant, M is the mass of the body and r is the radius.

Density is defined as mass per unit volume. It is an average of the combined densities of all the elements and their percentages contained in the Earth and not the density of the individual particles or elements. Dividing the mass of the Earth by the volume produces an average density of the material in the Earth as 5.5025 g/cm^3. When new matter of varied or unknown densities is added, the average density will change. However, when the new matter is the same as the original elemental matter, as it is postulated here, the density does not change and the total Earth's elements would have the same density today as they had a billion years ago. By adding mass, an expanding Earth could experience gradual changes in the overall average density due to compression aided by gravity, which would then be relieved by earthquakes, fissures, volcanism, stretching's, rifts, and etcetera resulting in volumetric increases.

On pages 4 and 5 of the earlier paper, two tables indicate equivalent increases in mass can balance an energy deficit of 1 eV every 2 million years. However, when converting all the energy of decay, it was observed too much mass was accumulating. Both tables indicated the mass was accumulating too fast and implied that only part of the decay energy was converting to mass. The second table also demonstrated small increases in density are necessary.

Returning to the law of conservation of energy that states the total amount of energy in a system remains constant over time. This law suggests energy can be transferred from one system to another in many forms. When energy converts to mass, the entropy of the universe increases because the potential energy of the universe increases by mc^2 the instant new matter appears. While decay represents a decrease in energy over time, entropy always increases over time. The Second Law of Thermodynamics states the entropy of the universe tends to a maximum. The entropy of the Second Law involves heat and temperature. Heat cannot be transferred from a colder to a hotter body and is therefore one directional and irreversible. Consequently, heat will move from a warmer system to a colder system and eventually will end up in the universe, the coldest system.

When the Earth coalesced some 4500 MYA, all the elements it contained at that time would have been in a near absolute zero environment and without a heating mechanism, the Earth would remain at that temperature. Similarly, those same elements would have been in an energy environment corresponding to a level of 2570 eV (4500 MY/ 1.75). This level is very energetic and falls within the x-ray range and, of the 5 elements, only silicon and sulfur could ionize to form compounds.

TABLE 3 IONIZATION POTENTIALS of the 5 ELEMENTS ©2013

Energy in eV

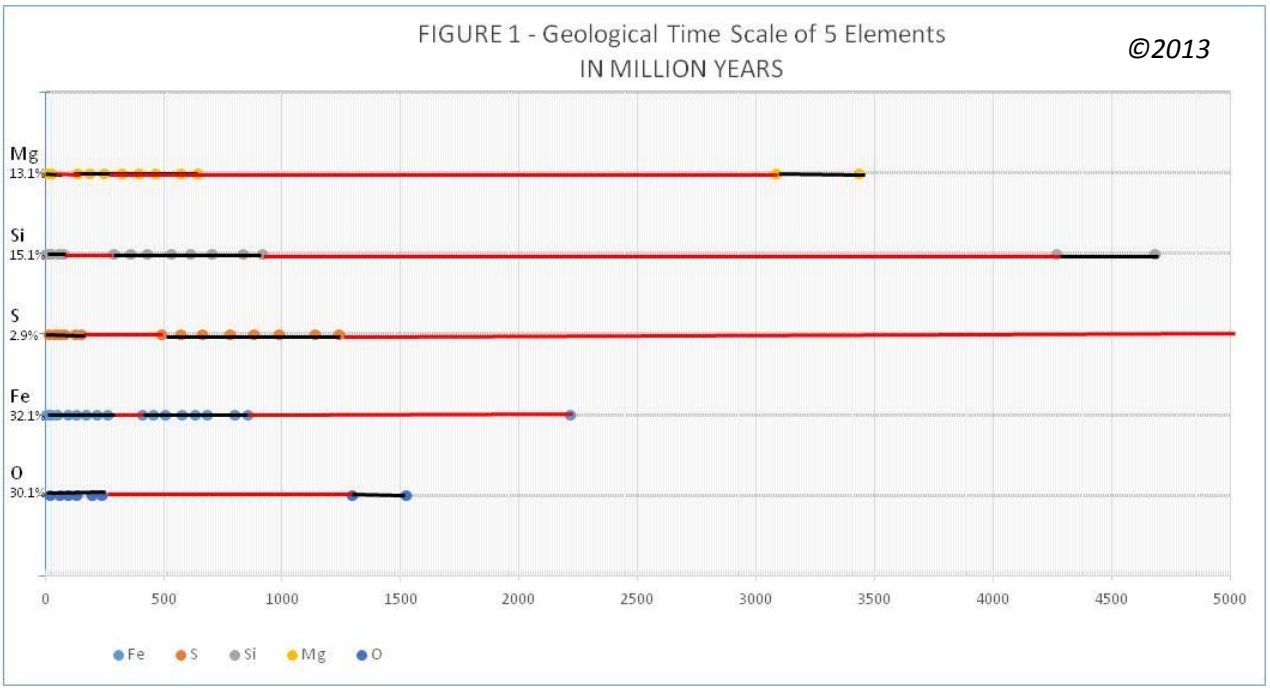
	Fe	S	Si	Mg	O
I	7.870	10.360	8.151	7.646	13.618
II	16.180	23.330	16.345	15.035	35.116
III	30.651	34.830	33.492	80.143	54.934
IV	54.800	47.300	45.141	109.240	77.412
V	75.000	72.680	166.770	141.260	113.896
VI	99.000	88.049	205.050	186.500	138.116
VII	125.000	280.930	246.520	224.940	739.315
VIII	151.060	328.230	303.170	265.900	871.387
IX	235.040	379.100	351.100	327.950	
X	262.100	447.090	401.430	367.530	
XI	290.400	504.780	476.060	1,761.802	
XII	330.800	564.650	523.500	1,962.613	
XIII	361.000	651.630	2,437.676		
XIV	392.200	707.140	2,673.108		
XV	457.000	3,223.836			
XVI	489.500	3,494.099			
XVII	1,266.100				

Time in MY

1.75x eV	Fe	S	Si	Mg	O
I	13.8	18.1	14.3	13.4	23.8
II	28.3	40.8	28.6	26.3	61.5
III	53.6	61.0	58.6	140.3	96.1
IV	95.9	82.8	79.0	191.2	135.5
V	131.3	127.2	291.8	247.2	199.3
VI	173.3	154.1	358.8	326.4	241.7
VII	218.8	491.6	431.4	393.6	1293.8
VIII	264.4	574.4	530.5	465.3	1524.9
IX	411.3	663.4	614.4	573.9	
X	458.7	782.4	702.5	643.2	
XI	508.2	883.4	833.1	3083.2	
XII	578.9	988.1	916.1	3434.6	
XIII	631.8	1140.4	4265.9		
XIV	686.4	1237.5	4677.9		
XV	799.8	5641.7			
XVI	856.6	6114.7			
XVII	2215.7				

Table 3 is an extract of Table 1 showing both the ionization potentials of the 5 selected elements on the left side and the time of the ionizations based upon a 1eV/1.75 million years rate on the right side. Highlighted is the anomaly that occurs once for oxygen and twice for the other four elements. The anomaly is the rather large jump that occurs between the shaded numbers of each element. A geological time scale in million years is graphed in Figure 1 with the time and duration of the anomalies shown in red.

The predominance of red between a billion years ago to ~5 billion years ago would indicate the 5 elements were producing heat since the question of how the Earth was initially heated has never been satisfactorily answered or proven. Currently, 20% of the initial heat is attributed to residual heat from planetary accretion and 80% through radioactive decay. As inferred above, matter bathing in near absolute zero temperatures would lose, rather than gain heat and assume the temperature of its surroundings. Speculating the early Earth heating was provided by depleted unknown radioisotopes would have been higher (twice present-day at approximately 3 BYA) does not account for the large loss of heat through the planet's early atmosphere, the first atmosphere. The second and third atmospheres resulted from the effects of volcanisms which occurred less than one billion years ago when sufficient elements were expanding in a very hot environment providing the pressure-thermal energy for the eruptions. The Sun, rightfully, is not mentioned as a source for heating the interior.



In Figure 1, one can see the many spectrum points on the solid lines for the equivalent amount of time exhibited on the red lines. This suggests only a small part of the total decay energy is converting to mass while the rest, during the longer period, is converting to an entropy involving heat. Because heat is one directional and non-reversible, a cause for this anomaly is not detectable by optical spectra. Between 1000 and 3000 MYA, the entropy turned the planet into a gigantic furnace that segregated some and combined some elements contained within. Most of the iron settled in the core while a hard crust of the lightest matter formed on the surface with temperatures greatly exceeding the boiling point of water. Water evaporated and remained as part of the early atmosphere and functioned as a cooling agent until ~850 MYA when only oxygen and magnesium were producing heat from within. As the Earth was cooling, rapid growth of the mass was progressing.

The Figure 2 graph covering 1,000 million years can be useful in identifying when decay energy converts to mass or to entropy. Oxygen united with hydrogen to form water molecules between 1,525 and 1,294 million years ago. From 1,294 million years ago to ~242million years ago the molecules were mostly producing heat and at ~242 MYA they resumed to acquiring only mass that enabled doubling every 26 million years to the present time. In the past 242 million years, water doubled 9.3 times for a 630 fold increase, meaning there is ~600 times more water today than there was 1,294 million years ago.

As a result of the above and the laws of conservation and thermodynamics, it is postulated that the energy of the universe is declining as it ages and is being stored as potential energy by converting some decay energy into matter within the elements and the rest to an entropy that eventually heats the universe. Simplified, the energy of decay is energy that has converted to mass and/or entropy.
Energy ↔ Mass → Entropy

Table 3 provides the time line from when an element first ionizes to converting energy to mass and when the mass is growing or heating the element.

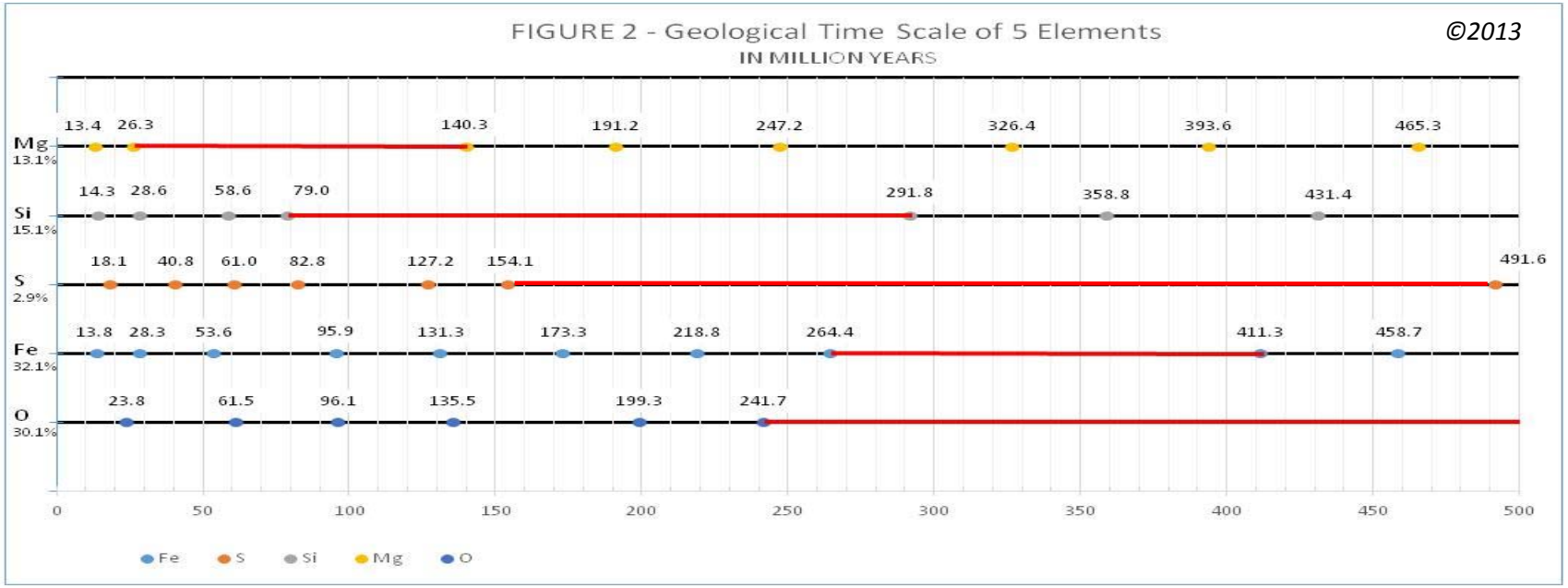
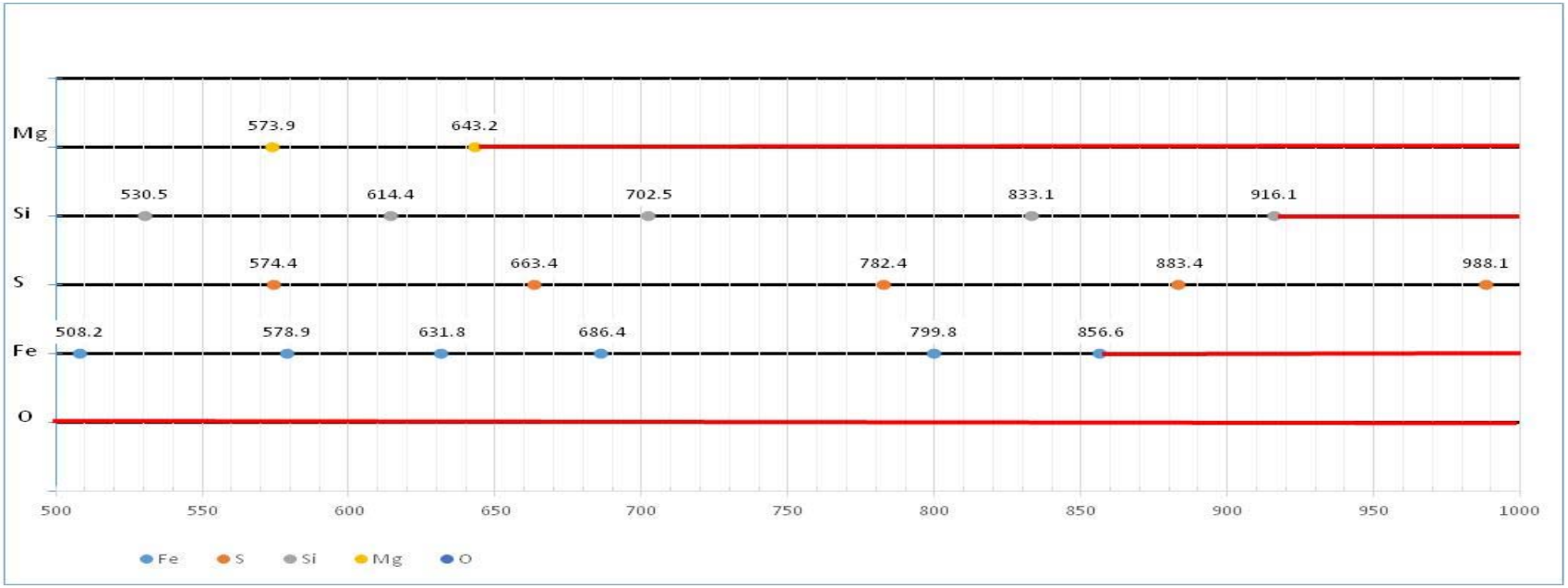


FIGURE 2 - Geological Time Scale of 5 Elements
IN MILLION YEARS
©2013
Mg
13.1%
13.4 26.3 140.3 191.2 247.2 326.4 393.6 465.3
Si
15.1%
14.3 28.6 58.6 79.0 291.8 358.8 431.4
S
2.9%
18.1 40.8 61.0 82.8 127.2 154.1 491.6
Fe
32.1%
13.8 28.3 53.6 95.9 131.3 173.3 218.8 264.4 411.3 458.7
O
30.1%
23.8 61.5 96.1 135.5 199.3 241.7
0 50 100 150 200 250 300 350 400 450 500
Fe S Si Mg O


Mg
573.9 643.2
Si
530.5 614.4 702.5 833.1 916.1
S
574.4 663.4 782.4 883.4 988.1
Fe
508.2 578.9 631.8 686.4 799.8 856.6
O
500 550 600 650 700 750 800 850 900 950 1000
Fe S Si Mg O

From Einstein's equation, $E = mc^2$, it is noteworthy that the units of the speed of light squared, m^2/s^2, and the units of specific entropy (specific heat capacity), $m^2/s^2\,K$, differ only by temperature. With the energy of decay equivalent to both mass and entropy, an equation to reflect this distinction would be: **eV = m_a**, (atomic mass) ***or*** **C_s** (specific entropy), where 1 eV ≅ 1.073544 atomic mass units and 1 eV ≅ 11,604.5 Kelvin. If the conversions of energy transpire within the Earth's elements over a 1.75 million year period, then the equivalent added mass or heat transpires (0.00663 K/yr) over that same period and at those same locations. The conversions to heat better explains how the planet initially warmed and remains fairly temperate, especially when the mass periodically doubles as required on an exponentially expanding Earth.

In Table 4 below, only the decay energy that converts to mass as indicated in Figure 2 is sought. Consequently, the exponential growth rate changes each and every time any of the 5 elements changes modes. The chart is composed of 11 variable growth rate changes in almost a billion years and the mass indicated at each point paints a picture that comports well with geological events as delineated on its Figure 3 curve on page 11.

TABLE 4 - VARIABLE EARTH MASS GROWTH RATES FROM IONIZATIONS of the 5 ELEMENTS *©2013*

MY	X	Element	Rate/eV	*e*	Mass (kg)	% of Current	
0	1			3.59375	5.9800E+24	100.00%	
26.3	0.263	-Mg	-0.57862	3.01513	4.4716E+24	74.78%	a
79.0	0.527	-Si	-0.57722	2.43791	2.7964E+24	46.76%	b
140.3	0.613	+Mg	0.57862	3.01653	1.4220E+24	23.78%	c
154.1	0.138	-S	-0.09710	2.91943	1.2262E+24	20.51%	d
241.7	0.876	-O x 55%	-1.11070	1.80873	7.2971E+23	12.20%	e
264.3	0.227	-Fe	-0.61707	1.19166	7.0128E+23	11.73%	f
291.8	0.275	+Si	0.57722	1.76887	5.9957E+23	10.03%	g
411.3	1.195	+Fe	0.61707	2.38594	2.1205E+23	3.55%	h
491.7	0.803	+S	0.09710	2.48305	1.0213E+23	1.71%	i
643.2	1.516	-Mg	-0.57862	1.90443	3.8476E+22	0.64%	j
856.6	2.134	-Fe	-0.61707	1.28735	2.2443E+22	0.38%	k

To adjust the mass when the decay energy of the 5 elements are producing heat as shown in Figure 2, the mass growth rates per electron volt calculated in Table 1 are consecutively added or subtracted (column 4) from the rate of exponential growth, *e*, (column 5) as each element changes mode. Every change requires a change in the rate of exponential growth. The mass in column 6 is the previous mass divided by e^x, the "*e*" is the exponential growth rate (column 5) and the "x" is the duration time in hundred million years (column 2). Only 55% of oxygen is used in these calculations since surface water does not contribute to Earth's internal expansion. Quanta mass doublings occurring at 12.5% ($1/8^{th}$) and at 1.56% ($1/64^{th}$) of current indicate the Earth first doubled in radius at some time near 540 MYA and redoubled at a time near 240 MYA.

The varying exponential growth rates derived and presented accounts for the total Earth mass expansions which include both the oceanic and the continental crusts together. Separately, the oceanic crust is expanding faster than the continental crust; nevertheless, both are expanding at the same time. This point is generally overlooked when fitting the continents together on a smaller globe. An equation

for the variable rate exponential mass growth due to the ionization properties of the 5 elements producing Table 4 is:

$5.98E+24 / 3.59375^{1} = a$	$d / 2.91943^{0.138} = e$	$h / 2.39803^{1.195} = i$
$a / 3.01513^{0.263} = b$	$e / 1.90970^{0.876} = f$	$i / 2.498692^{0.803} = j$
$b / 2.43791^{0.527} = c$	$f / 1.29263^{0.227} = g$	$j / 2.00540^{1.516} = k$
$c / 3.01653^{0.613} = d$	$g / 1.86985^{0.275} = h$	

Figure 3 on page 11 is a graph of this table. The colors on the graph mimic the color codes of the Age of the Ocean Floor NOAA map (MGG-12, 1996). The graph also depicts times older than 180 million years when the light gray and white shelving areas on the NOAA map were formed. Figure 1 indicates that prior to 900 MYA; practically all the ageing energy converted to entropy and very little converted to mass. The early Earth, in a near absolute zero temperature setting, was initially heated from within during this +3 billion year period. From here to about 643 MYA around 50% of the critical elements were gaining mass and 50% were gaining heat. Such a combination within a very hot mantle/core provides the kinetic energy for a secondary system to cause intense earthquakes and volcanism piercing and weakening the hard crust. A great number of volcanoes formed during that period and the associated gasses spewed from them changed and created a second atmosphere.

An interpretation of the data indicates that sometime between 643 MYA and 492 MYA when all but oxygen was adding to the mass; a broken and volcano peppered Pangaea violently separated near 550 MYA principally in the North Polar Region, completely around a joined Australia and Antarctica, and at most continental edges. The separations formed the early sea beds that lengthened and widened slowly as mass growth reduced when sulfur, iron, and silicon switched to its heat mode to about 292 MYA. Shelf building activity from the time of the Pangaea break-up ~550 MYA to 292 MYA is shown as the white shelving areas on the NOAA map. Water would migrate and collect as seas or lakes on these shelves which were lower in elevation than the continents.

From 292MYA to 264MYA only magnesium's 13.1% of total Earth was actively producing new mass and the ~85% producing heat started a 28 MY period of increasing global heating, mostly to the determent of all plant and animal life on land. At 264 MYA, iron joined magnesium to again make~50% of Earth's elements actively adding mass and 50% adding heat until 242 MYA. During this period, the intense earthquakes and volcanism re-appeared, upsetting the water tables and producing a third atmosphere. Abrupt interruptions of the water tables would drain seas and lakes much to the detriment of sea life. The combination of increasing temperatures, quaking, water displacement, and a changing atmosphere throughout the Permian heavily impacted upon all forms of life on the planet yielding the greatest extinction recorded at 250 MYA. Without an internal heating and expansion mechanism, those events would not have occurred.

Prior to 242 MYA, around the beginning of the Triassic, the amount of water on the planet was ~600 times less than the present and all previous expansions would entail drops in sea levels. From 242 MYA to the present, water doubled in volume every 26 million years. When this constant rate exceeds the variable rate of mass doublings, sea levels would rise and when reversed, sea levels would fall. Between 242 MYA and 190 MYA the water doubled twice (4 times in volume) and at 180 MYA the water would have been ~120 times less than today's.

From 242 MYA to 154 MYA when all except silicon (15.1%) and sulfur (2.9%) were adding mass, volcanism slowed while expansion at the surface increased. New shelving formed a ring that completely encircled the continents of Australia and Antarctica when they were joined. The joined continents, along with the new shelf material that surrounded them, were displaced as a unit by subsequent Pacific oceanic expansions starting ~180 MYA. These shelves are described as sediment covered and depicted as light gray on the NOAA map. There may be remnants of this shelf material on the ocean floor included in that Western Pacific blue color shown on the map above Australia. The accelerated expansion from 180 MYA to the present matches the NOAA map color codes representing the ages of the ocean floor.

It is significant that all the points in Table 4 and Figure 3 are at or very close to the period boundaries where highly significant changes of the fossil record are noted. For instance, the time in the table's first column indicate:

26.3 MYA- at the Oligocene-Miocene boundary at 25MYA,

79.0 MYA- at the Cretaceous-Tertiary boundary at 66 MYA,

140.3 MYA- at the Jurassic-Cretaceous boundary at 140 MYA,
154.1 MYA- at the Jurassic-Cretaceous boundary at 140 MYA

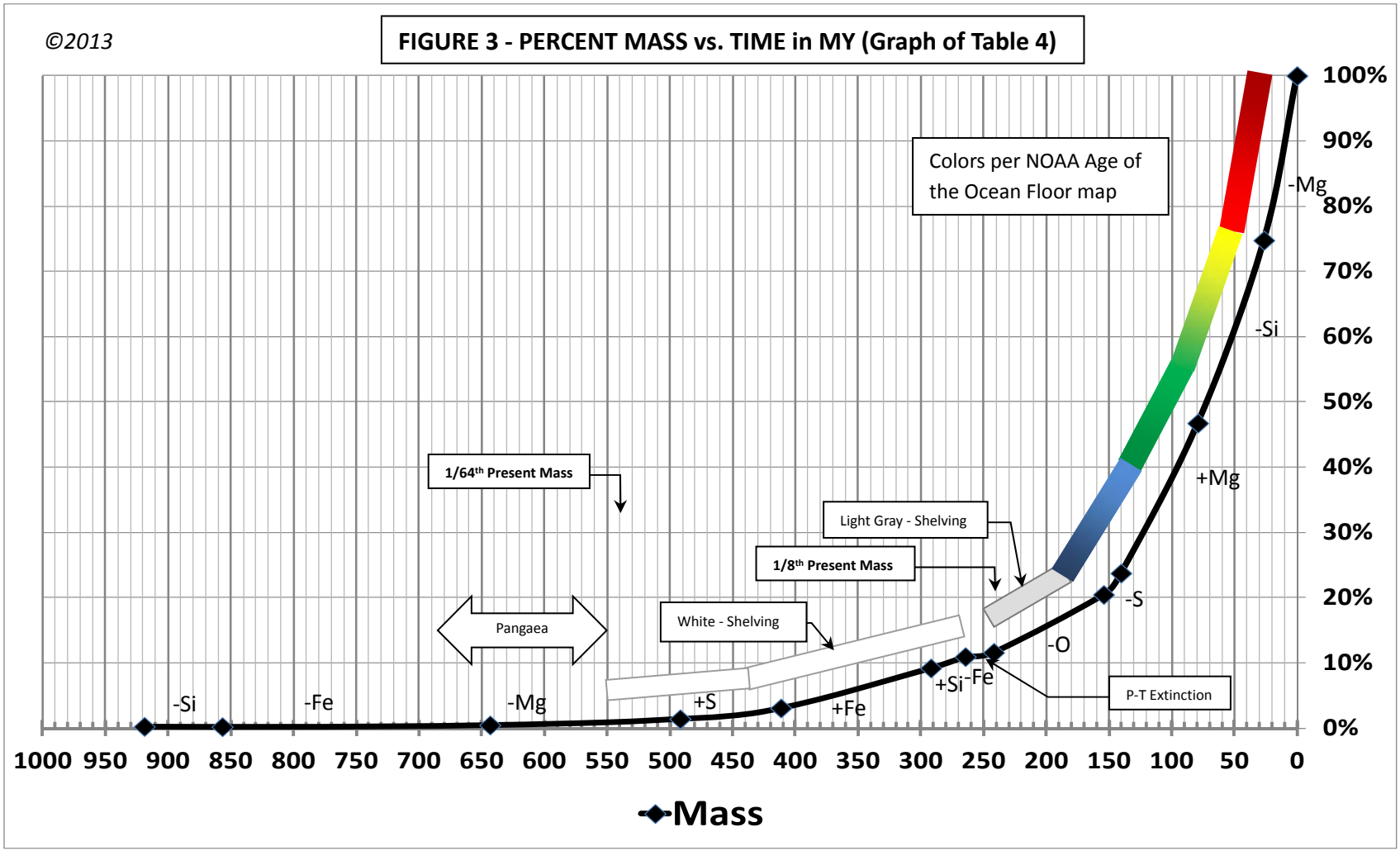
241.7 MYA- at the Permian-Triassic boundary at 250 MYA,
264.3 MYA- at the Permian-Triassic boundary at 250 MYA,

291.8 MYA- at the Carboniferous-Permian boundary at 290 MYA,

411.3 MYA- at the Silurian-Devonian boundary at 410 MYA, and

491.7 MYA- at the Cambrian-Ordovician boundary at 500 MYA.

EXPANDING EARTH - MASS INCREASE TIME SCALE



Note: Reverse element signs (+ and -) when reading from past to present (left to right)

The volume and radius present a different problem since the average density is dependent upon a mass that is compressing as it is growing at increasing exponential rates. Because of Earth's great mass, a mass that doubled at least twice during the past 140 million years, it creates a gravity that increases compaction of the Earth and makes it denser. The effect of exponential mass growth on the force due to gravity and the acceleration due to gravity are indicated in two equations as follows:

(1) $F = G M_s M_e / R^2$ where:

$= \not{G}\not{C} M_e / R^2$ F = force R = Earth-sun orbital radius

G = constant r = Earth radius

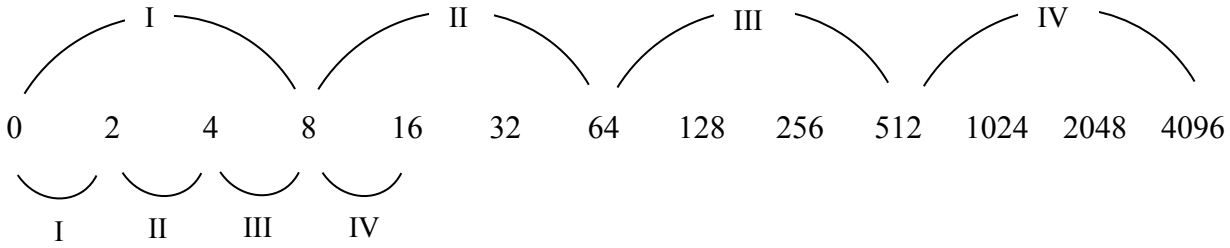
(2) $g = G M_e / r^2$ M_s = mass of sun g = surface gravity

$= \not{C} M_e / r^2$ M_e = mass of Earth *r* = both R and r

The mass of the sun is so large and the percent change is so small, it is treated as a constant. By cancelling the constants, M_s and G, Equation (1) equals Equation (2). An 8 fold increase in mass will double the radius in each equation and an 8 fold increase of the previous mass will double the previous radius:

	I ($r = 1$)	II ($r = 2$)	III ($r = 3$)	IV ($r = 4$)
	first doubling	second doubling	third doubling	fourth doubling
F = g =	$8M_e / 2(r)^2$	$64M_e / 4(r)^2$	$512M_e / 8(r)^2$	$4096M_e / 16(r)^2$
series	2	4	8	16

Both equations show exponential doubling of the mass in the upper portion and of the radius in the lower portion straddling an exponential series:



Two quanta jumps of the mass (an 8 fold and a 64 fold increase) are indicated in Table 4, one around 240 MYA with 1/8th (12.5%) of the present mass and the other around 540 MYA with 1/64th (1.56%) of the present mass. The above equations would indicate 50% gravity ~240 MYA when the Earth's radius was 50% of the present and its distance to the sun was halved. At around the time of the Pangaea break-up,

the gravity, the radius, and the distance from the sun would have been about 1/4th of the present. The above equations would be 100% correct if both the mass and the volume follow the same exponential curve path and the density remaining constant. Compression, although not included in the equations, is a major factor for consideration. When the force, F, and gravity, g, are comparatively small, as in the early Earth, the comprising matter was more loosely packed and the Earth would be less dense. As the mass doubles and triples, the effect of gravity compresses all the matter within and the Earth becomes denser. One could easily attribute this compression and increased density to the force (Equation I) or the acceleration due to gravity (Equation 2). While the mass is in compliance with the mathematics and doubling every 8 fold increase of the previous mass, the volume is constrained by the effects of compression/gravity and follows the lead of the accumulating mass to express expansion at a later time.

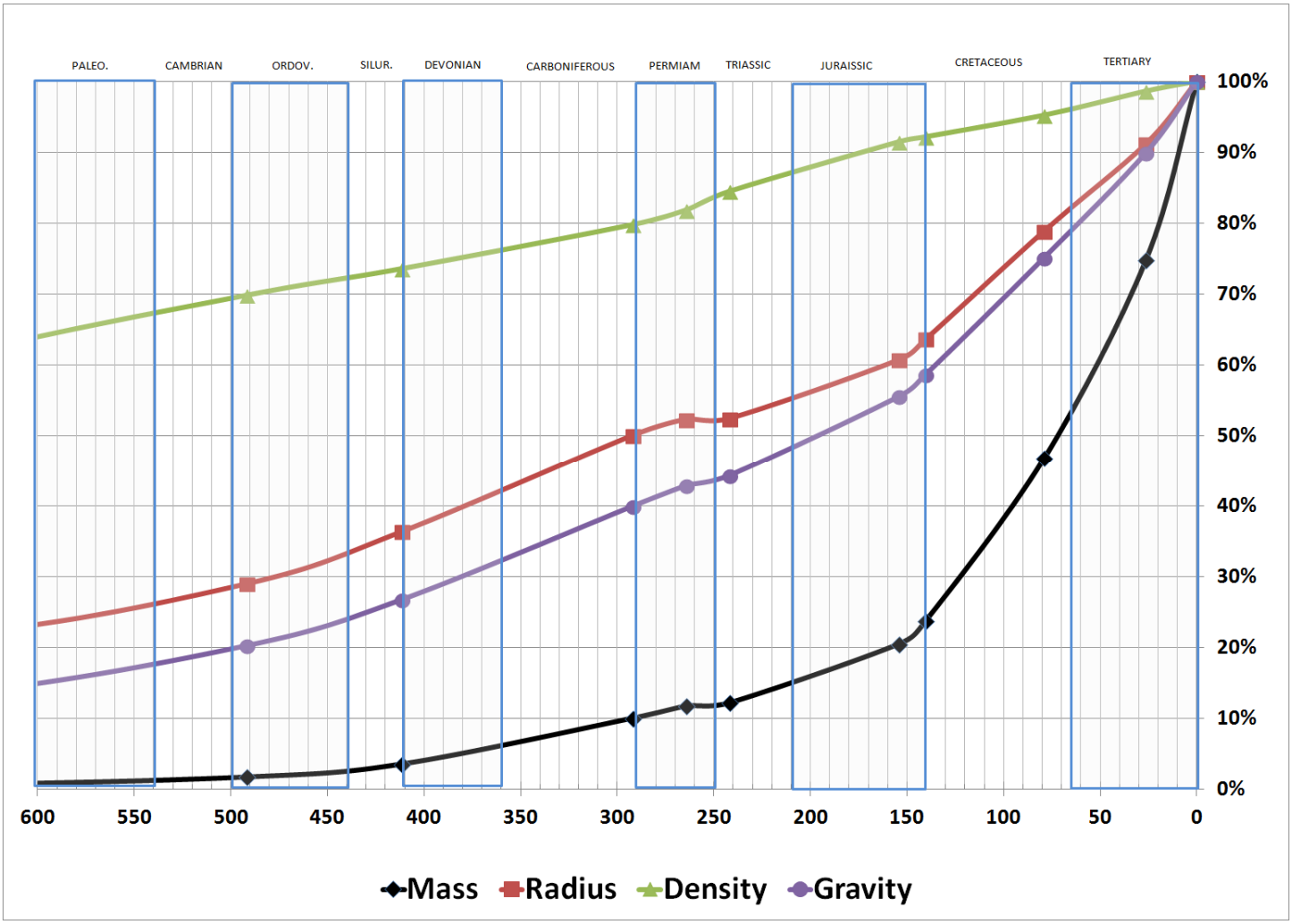
To compensate for the effects of compression and gravity on the mass of an expanding Earth two rates are necessary, one for the increasing mass and one for the lagging volume. Toward this end, the exponential rate of 3.59375^{x} is initially used for calculating a mass that doubles every 54.17 MY. A slower initial rate of 53.13 MY representing a one million year lag is used for calculating the radii, although other rates are possible. The results produce radii lagging the growing mass are indicated in the red shaded column of Table 5 on the next page. From this radius example, density and gravity were calculated and graphed in Figure 4. Most notable on the graph are (1) the mass and radius essentially ceases to grow for the period between 241.7 MYA and 264.3 MYA, the time bracketing the great Permian-Triassic extinction, (2) the gravity ranges between 44% and 49% during the Triassic Period, (3) the initial 1 MY lag appears to reduce the rate of growth a notch each time the slope of its Figure 4 mass curve changes, and (4) the gravity is very close to the 25% predicted for the time when the Earth was 1/64th of the present mass. The break-up of Pangaea started ~643 MYA when magnesium changed modes leaving only oxygen producing heat until ~492 MYA. The Radius-Density-Gravity curves end at 600 MYA because the unknown density due to compression within the sphere before the Pangaea break-up should have been greater than after the crust was severely broken and the Earth's integrity was forever weakened to the point where the volume could expand more freely at the cracks with less compression. This is probably why the continents retained their original relative shapes (while growing upward and outward) throughout the geological periods with the greater expansions appearing as continental shelf materials or oceanic basalt materials.

Finding a radius to match the mass at any particular time as described above is desirable yet, somewhat tentative. One should recognize the radius is not the primary subject matter of this paper and that the ionization properties of a few elements explain and demonstrate how, when and why the Earth's mass is growing and heating. It is the increasing mass that allows the volume to expand from mounting compression that involves a gravity the mass creates by growing. When those individual elements are not growing, they are providing heat. The entropy answers how the planet initially warmed from within and maintained the heating thereafter. Knowing the mass throughout the ages should help in quantifying the amounts of heat produced. The ionic implications are far reaching.

TABLE 5 -MASS FROM TABLE 4 WITH LAGGING RADII ©2013

				(54.17 MY)			(53.13 MY)						
MY	X	Element	Rate/eV	Rate of Growth	Mass (kg)	Current Mass	Rate of Growth	Radius (km)	Current Radius	Density (g/cc)	Current Density	Gravity (m/sec^2)	Current Gravity
0	1	0	0	3.59375	5.98E+24	100.00%	3.43750	6378.96	100.00%	5.50	100.00%	9.80	100.00%
26.3	0.263	-Mg	-0.57862	3.01513	4.47161E+24	74.78%	2.85888	5817.01	91.19%	5.42	98.61%	8.81	89.92%
79.0	0.527	-Si	-0.57722	2.43791	2.79642E+24	46.76%	2.28166	5032.65	78.89%	5.24	95.23%	7.36	75.13%
140.3	0.613	+Mg	0.57862	3.01653	1.42201E+24	23.78%	2.86028	4060.81	63.66%	5.07	92.17%	5.75	58.68%
154.1	0.138	-S	-0.09710	2.91943	1.22624E+24	20.51%	2.76318	3875.00	60.75%	5.03	91.48%	5.45	55.57%
241.7	0.876	-O x 55%	-1.11070	1.80873	7.29709E+23	12.20%	1.65248	3346.46	52.46%	4.65	84.52%	4.35	44.34%
264.3	0.227	-Fe	-0.61707	1.19166	7.01281E+23	11.73%	1.03541	3337.67	52.32%	4.50	81.87%	4.20	42.84%
291.8	0.275	+Si	0.57722	1.76887	5.99567E+23	10.03%	1.61262	3194.75	50.08%	4.39	79.81%	3.92	39.97%
411.3	1.195	+Fe	0.61707	2.38594	2.1205E+23	3.55%	2.22969	2321.08	36.39%	4.05	73.61%	2.63	26.78%
491.7	0.803	+S	0.09710	2.48305	1.02133E+23	1.71%	2.32680	1851.36	29.02%	3.84	69.86%	1.99	20.28%
643.2	1.516	-Mg	-0.57862	1.90443	3.84756E+22	0.64%	1.74818	1396.19	21.89%	3.37	61.36%	1.32	13.43%
856.6	2.134	-Fe	-0.61707	1.28735	2.24427E+22	0.38%	1.13110	1279.04	20.05%	---	---	---	---

FIGURE 4 - MASS, RADIUS, DENSITY AND GRAVITY CURVES OF TABLE 5 (TIME IN MY VS PERCENT OF CURRENT VALUES) ©2013



Seven last points:

1. Fractional equivalents are used in the mass equations because doubling connotes the fraction 1/2; hence 3 9/16^{ths} equals 3.5625 or 3 7/16^{ths} equals 3.4375.

2. Entropy is a measure of the unavailable energy in a thermodynamic system and involves heat and temperature (2nd Law). It should not be confused with the entropy of physical systems that uses the number of bits needed to describe the detailed state of a system; Boltzmann for statistical entropy and Shannon for informational entropy.

3. Earth's internal heat from radioactive decay is in addition to the heat from ionic decay. The heat-producing isotopes, like the 5 elements would only provide heat in the locations those radioactive elements are present. To heat the core, sufficient radioactive iron isotopes should be located in the core. Lord Kelvin never truly accepted radioactivity as the primary source of Earth's heat.

4. Growth patterns and geological events are influenced not only by the distribution and the concentration of the 5 elements throughout the geologic layers but primarily when the decay energy converts from mass to entropy or from entropy to mass within an element. Iron with 32% of Earth's matter mostly in the core should have a greater effect than the 15% silicon scattered in the mantle/crust. However, silicon doubles every 46 MY while iron takes 91 MY, making the average effect almost equal. This same average effect exists between magnesium and silicon making these three elements almost equal in capability when all are producing mass.

5. Geologist might recognize the significance of the data in Table 4 and its graph in Figure 3 as providing a cause and effect relationship that connects with the boundaries between the periods. These boundaries indicating mass extinctions and global catastrophes can credibly be attributed to an ionic expanding Earth since every time any one of the five elements changes mode from heating to growing or vice-versa, that time occurs at or near a geological boundary. Ionization could be described as a plausible mechanism for expanding the Earth.

6. Ionization as a mechanism applies to the elements and only extends to the atoms that comprise each element. The individual elements grow and exist in varied sizes and therefore its atoms should do likewise. The mechanism applicable to the atoms is only addressed notionally and is yet to be determined.

7. The mass increases outlined include matter from cosmic dust, comets, meteorites, and asteroids. These cosmic factors would change the mass growth if they contain any of the 5 elements. Only the decay energy converting into mass within the 5 existing elements is considered by using the present Earth doubling rate of 54.17 MY (3.59375^{x}), and a radius lag rate of 53.13 MY (3.4375^{x}). The mass doubling rates from Table 1 indicate 93.3% of the Earth's mass presently is doubling every 50.69 MY and corrected to 100% at 54.33 MY. A 54.17 MY rate was chosen to represent the total Earth rate although other compatible rates are possible. Bracketing the 54.17 MY doubling rates above and below with the same exponential lag, uncertainty curves were obtained for any time between a 52.10 MY doubling and a 56.53 MY doubling. Figure 5 is applicable to the ionic growth of the mass in this range and is based upon a present mass that would include any past external cosmic accretion or any internal new matter. Figures 6, 7 and 8, similarly show the relative uncertainty for the radius, density, and gravity within the shaded areas.

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FIGURE 5 - UNCERTAINTY ON MASS CALCULATION

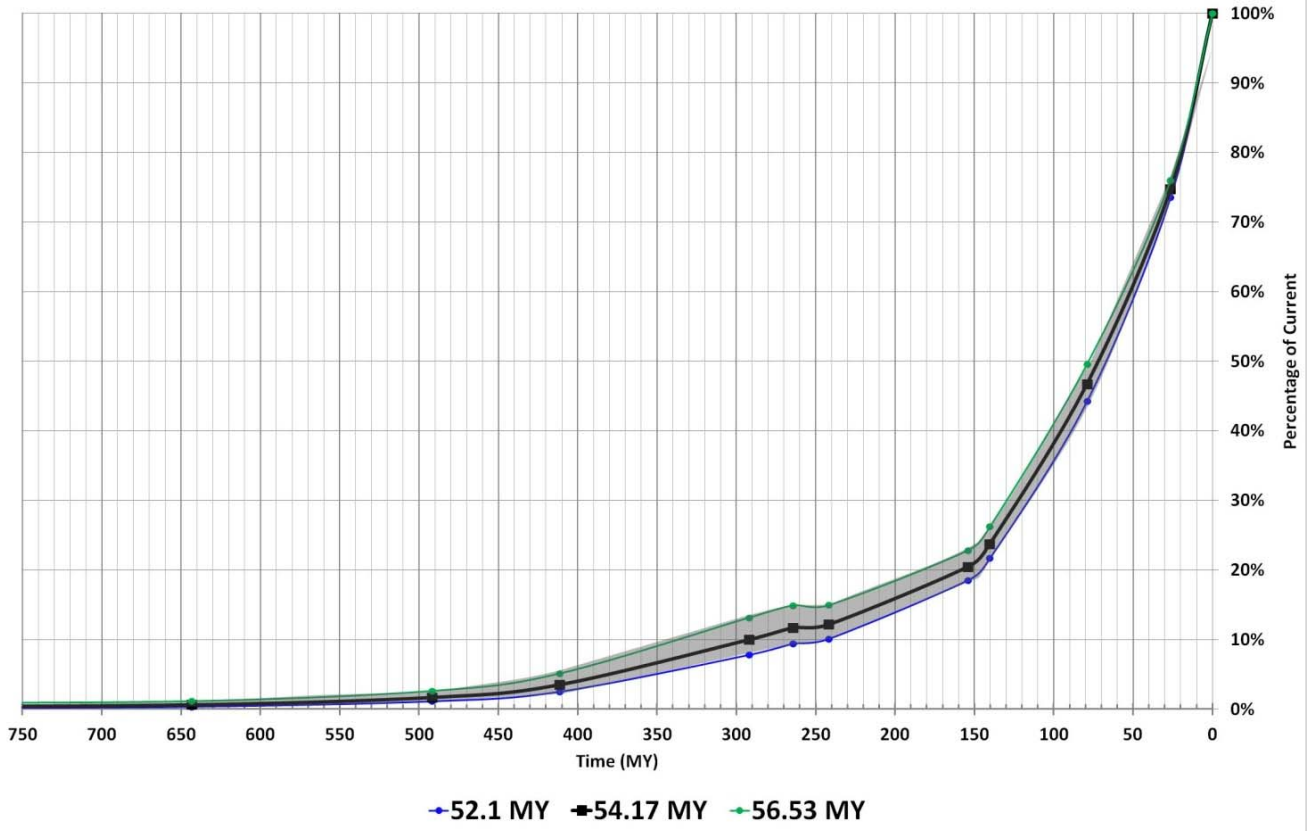

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FIGURE 6 - UNCERTAINTY ON RADIUS CALCULATION

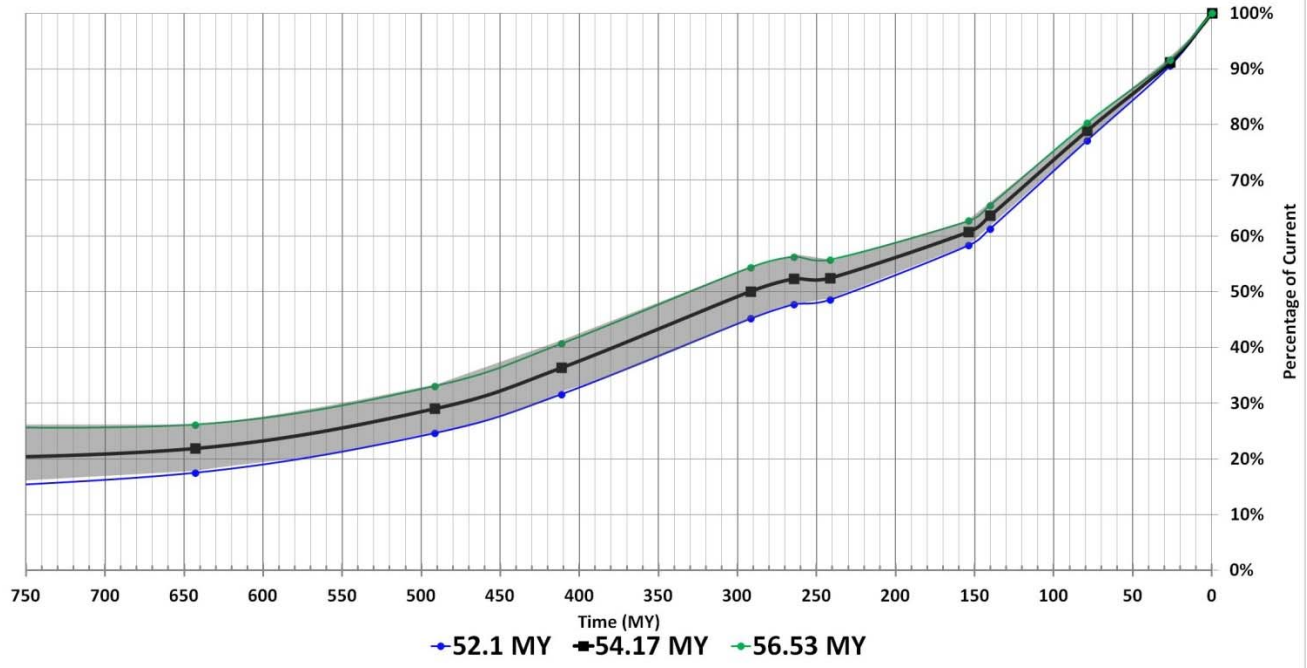


FIGURE 7 - UNCERTAINTY ON DENSITY CALCULATION

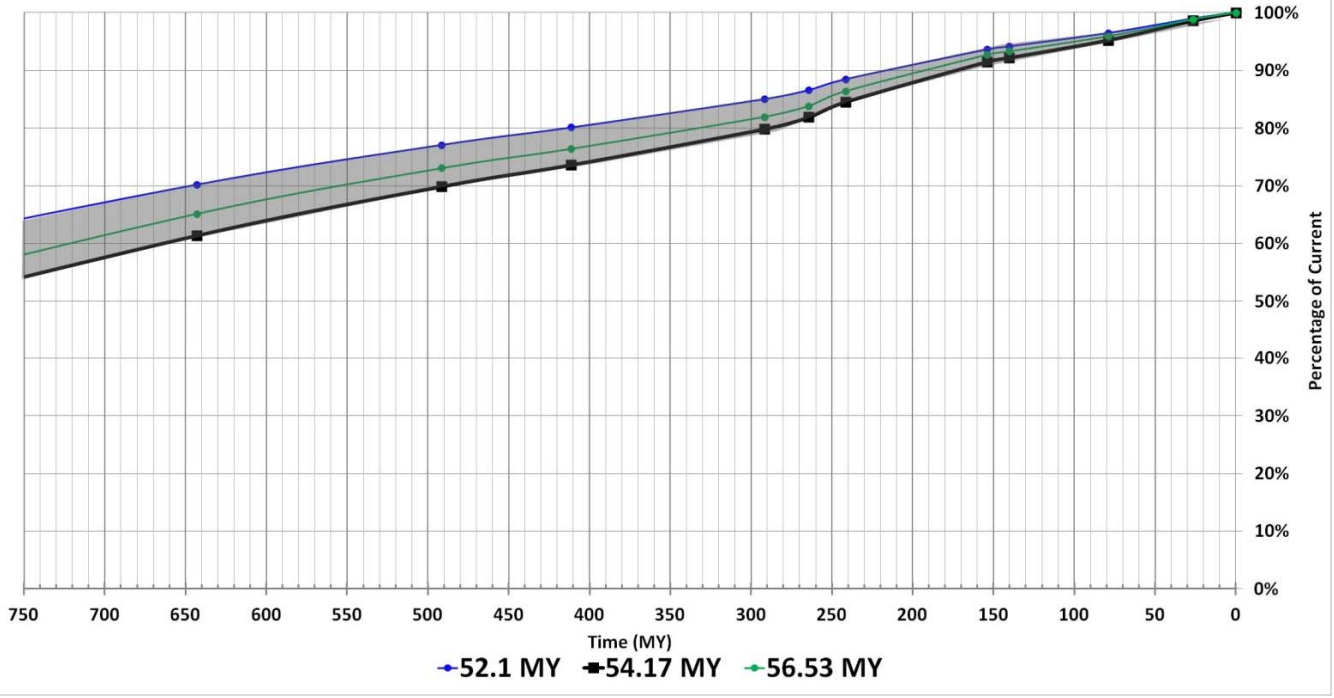
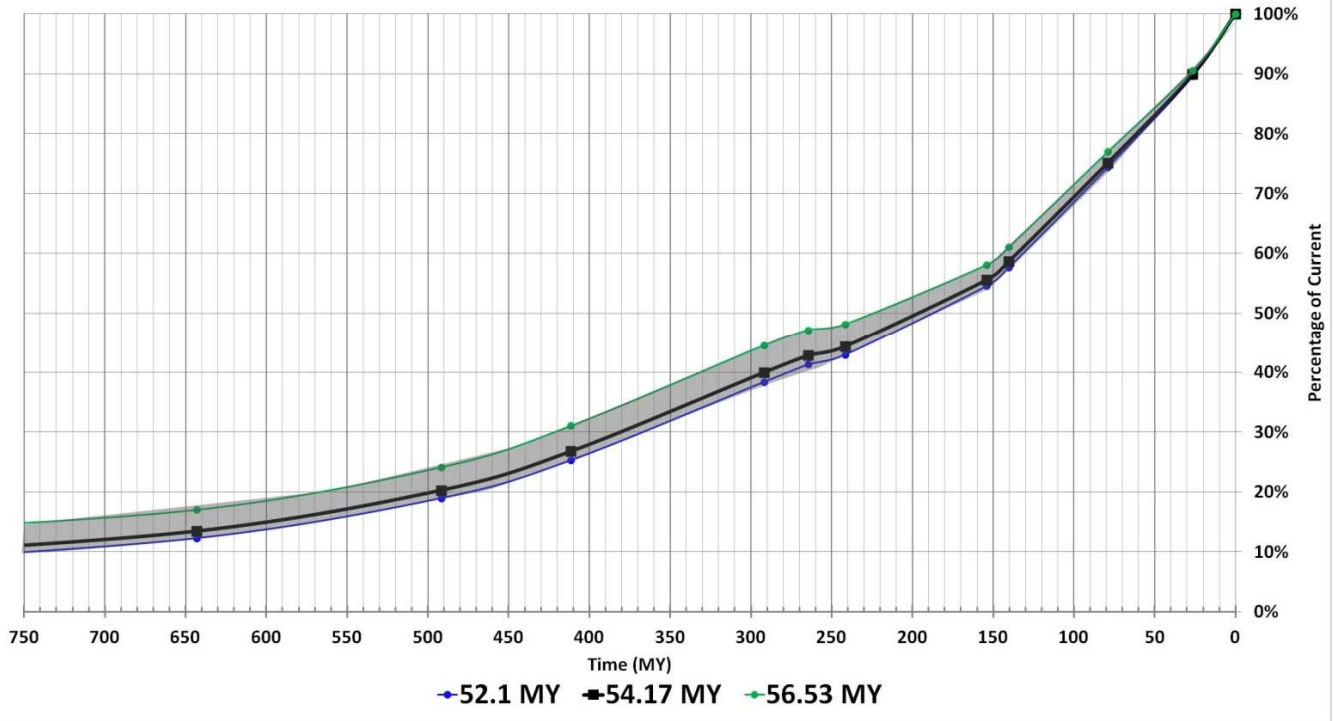


FIGURE 8 - UNCERTAINTY ON GRAVITY CALCULATION



Observations and Conclusions

Postulating Bohr's atoms incrementally increasing in mass and periodically doubling are the results of associating ionization data with geological time. Five existing elements, O, Fe, Si, Mg, and S, doubled the Earth's radius **twice** in less than a billion years by accumulating mass in their atoms, mass that first started to grow at the highest ionization level shown in Charlotte Moore's NBS-34 tables. The same five elements initially heated a cold, near absolute zero planet from within for several billion years with minimal expansion and later, maintained a fairly temperate environment that permitted life to propagate as the expansion accelerated exponentially. Each element, upon ionization, acquires mass and heat from the energy we think of as decay, but generally not at the same time. It's as if the atoms of an element have a switch that turns to "heat" or to "mass" at pre-programmed times. It is more than coincidence that every time the switch turns, a major event occurs at a geological boundary typically representing a period between extinctions. A growing Earth becomes understandable when the energy of decay which occurs over geological time is viewed as a diminishing ionic process. Entropy is difficult to understand mainly because of science's multiple meanings of the term and not providing a realistic answer to the origin of the heat that initially and subsequently warmed the planet. The origin of the energy appears to be the amount of energy the elemental atom possesses at the time of its ionization limit, sort of an ambient energy level for that particular time. The narrative, the charts, and the graphs attempt to show how the dwindling energy of five elements that comprise +93% of the Earth is capable of heating a dry frigid planet and doubling its radius. The process may seem complicated, confusing or even paradoxical, but it is comprehensible when combined with physical knowledge and the governing laws of nature. In this respect, elemental ionization becomes a plausible mechanism for both expanding and heating the Earth.

Currently, the Standard Model of Particle Physics does not extend to the expansion of the universe; however, the particle researchers may soon discover the causal mechanism of this ionic process in the Higgs boson, the atom's mass giving particle... or the switch? The Table 4 results imply the same ionic growth process within the elements could apply to the other 4.9% baryonic matter in the universe. It is conceivable that some or all of the 26.8% missing matter in the universe, the dark matter, could be found in new mass that grows the 4.9% atoms, and some or all of the 68.3% missing energy, the dark energy, could be found in the entropy that produces the 2.7 Kelvin temperature in the empty space and in the heat stored within the Earth and other celestial bodies. In such a scenario, the natural divide line would be at a time the first element in the universe ionized. On Earth, calcium was the first element to ionize ~10 billion years ago and become the first element capable of converting energy to mass and/or entropy. Using this figure for the universe, an accounting of such a procedure is charted below:

	ENERGY ⟷	MASS ⟶	ENTROPY		©2013
The Beginning	100.0%			= 100%	**BEFORE**
The Big Bang	-4.9%	+4.9%			**IONIZATION**
~10 BYA	95.1%	+4.9%		= 100%	**AFTER**
					IONIZATION
(dark energy)	-68.3%	⟶	+68.3%		
(dark matter)	-26.8%	+26.8%			
The Present	~0	~31.7%	+68.3%	=100%	

Introducing a third entity after ionization, entropy- representing heat, to the Standard Model's energy and mass entities, would locate and eliminate the need for dark matter and dark energy. The 4.9% baryonic matter would represent the first 20 or 30 elements on the Periodic Table that were present Before Ionization and suggests the remaining elements were formed from those 20 or 30 within the furnace of a mother planet, Earth in our case.

James Maxlow's extensive ocean retraction work demonstrates exponential growth of the radius. His reconstructions show how the Earth could have expanded by using UNESCO plate data over a 200 MY period. Deducting the continental expansions during that time period could further reduce the size of the models. In order to produce Stephen Hurrell's reduced surface gravities in the past, the rate of exponential growth of the mass must be greater than the rate of exponential growth of the radius. The lower than predicted 50% surface gravity occurring during the Permian was produced by lagging the growth rate of the radius. The density of each element remains constant throughout the eras because the added new matter is the same as the old matter. Adding new matter slightly changes the average density of the Earth due to compression that is influenced by gravity. While the mass expansions correlate well with geological events, the presented radius example is more tenacious.

Abstract

THE IONIC GROWING EARTH
A Mass and Entropy Theory
For an Expanding Earth in an Expanding Universe

The energy of the universe is declining as it ages; some of which is being stored as potential energy by converting to mass within existing elemental atoms and the rest to an entropy that eventually heats the universe.

On Earth, the declining energy of 5 elements (O, Fe, Si, Mg and S) as exemplified by their ionization properties, is responsible for accumulating sufficient mass to double the Earth's radius at least twice in the past billion years. Before that time, the energy converting to entropy from the same five elements internally heated a near absolute zero planet for several billion years and afterwards, provided sufficient heat to maintain a fairly temperate environment to support life while exponentially growing to its present size. It is responsible for the oxygen in water doubling in volume almost 7 times for a 120 fold increase during the past 180 million years to incrementally fill the growing ocean beds shown on the NOAA map, Age of the Ocean Floors. Ionization is presented as a feasible mechanism for expanding and heating the Earth.

The accelerated expansion of the universe is likely a reflection of the exponential growth of the mass on earth and the other 4.9% baryonic matter believed to exist in the universe. Adding entropy to the mass-energy equation after the first time an element ionizes eliminates the necessity for dark matter and dark energy.
Energy ↔ Mass → Entropy