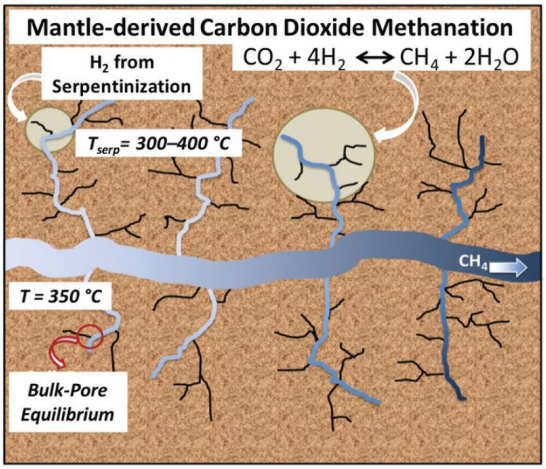
LEXICON -- RICHARD F. CRONIN – OCT. 26, 2025

Abiotic hydrocarbons – hydrocarbons formed through geological and chemical processes, not from the decomposition of ancient organisms nor biomass. They are produced in deep Earth environments under extreme pressure and temperature. Hydrocarbons on other planets and moons are all produced from abiotic processes. See Serpentinization, Fischer-Tropsch, Sabatier reactions and Fossil Fuels. All of these reactions are exothermic (generate heat). The image below depicts a Sabatier reaction. See "Deep Carbon, Past to Present", publ. 2019.



Caption: A schematic explaining how carbon dioxide may turn into methane in tiny fractures within ocean crust. *Credit:* From Cole D, Striolo A (2019) The Influence of Nanoporosity on the Behavior of Carbon-Bearing Fluids. In Orcutt BN, Daniel I, Dasgupta R, eds. 2019 Deep Carbon: Past to Present. Cambridge UK: Cambridge University Press. Courtesy of Thu Le et al./Scientific Reports

Actinides – Final series (bottom row) of the Periodic Table, containing Atomic Numbers 92 (Actinium) to 103 (Lawrencium) with the heaviest Atomic Masses = 227 to 266. This series is radioactive and contains the fissile elements like Uranium 235 and Plutonium plus the fertile elements like Thorium and Uranium 238, i.e. transmutable to a fissile element.

Activation Energy (Arrhenius Activation Energy) - is the minimum energy required for a chemical reaction to occur, representing the energy barrier that reactants must overcome to form products. Ignition energy.

Aerogels – are synthetic, ultralight solids derived from a gel, where the liquid component has been replaced by gas, making them up to 99.8% air. Aerogels are used in miniature nuclear warheads to produce the ideal spherical shape of the nuclear trigger and minimize the amount of fissile material to achieve Criticality. See Fogbank (It's a Big Secret - Heh, Heh)

Aesthenosphere - the upper layer of the earth's Upper Mantle below the Lithosphere in which there is relatively low resistance to plastic flow. The Aesthenosphere is described as elastic. The Upper Mantle also has regions of molten carbonate and silicate minerals.

Aleutians Islands – island chain extending from Alaska to the Kamchatka Peninsula. Also described as the Aleutian Arc and defined by the Aleutian Trench. The Aleutian Trench is a subduction zone where the Pacific Plate is sliding beneath the North American Plate. The trench extends for 3,400 kilometers (2,100 miles) from a triple junction in the west with the Ulakhan Fault and the northern end of the Kuril–Kamchatka Trench.

Alumina – Aluminum Oxide (Al2O3). A catalyst in Sabatier reactions to make methane, petroleum, and water.

Angstrom (Knute) – Son of Andres Angstrom. Disproved the demonstration of the alleged Greenhouse Gas Effect of CO2, as proposed by John Tyndall.

Anthracite – also called hard coal, anthracite is a hard, compact, and lustrous type of coal with the highest carbon content of all coals, typically ranging from 86% to 97%. It burns cleanly with a low-smoke, blue flame and is used for heating, power generation, and industrial processes like iron production. Formally used for coal-fired steamboats.

Aphelion – the point in the orbit of a planet, asteroid or comet at which it is furthest from the sun. Earth's Aphelion is in early July.

Apogee – the highest or most distant point of an object in flight or movement

Arrhenius (Svente) – Swedish chemist who originated the awareness of Activation Energy. Also attempted to calculate the "greenhouse gas effect", but grossly oversimplified his analysis by holding global humidity to a fixed value of ten (10) grams moisture per cubic meter.

Asbestos – One of the serpentine minerals with a pronounced spiky, dendritic surface, previously used for insulation and house siding. Now banned as a significant respiratory hazard. White asbestos, the most spiky dendritic form of asbestos, was previously sprayed onto movie sets to provide a snow scene. ("White Christmas" & "It's a Wonderful Life".)

Asteria – Hypothetical binary dwarf planet system proposed by Robert J. Tuttle. The two bodies spiraled into one another, broke apart (or exploded) and resulted in the asteroid belt. The location of the asteroid belt conforms to the Titus-Bode Law of planetary spacing.

Atlantic Meridional Overturning Current (AMOC) – the major ocean current system in the Atlantic that acts as a giant conveyor belt, transporting cold dense water south along the ocean floor. Warm less dense water flows north on the surface. This system is crucial for regulating global climate by distributing heat and influences weather patterns around the world. It is driven by density differences in seawater caused by temperature and salinity; warmer, less-salty water flows north. The warm waters melt icebergs from below. Salt is excreted and water in the polar regions becomes denser, sinks, and then flows south along the ocean floor.

Aurora Borealis – a natural light display in the sky caused by collisions between positively charged cosmic rays and coronal mass ejections from the sun with atoms in Earth's atmosphere. These charged particles, carried by the solar wind, are redirected by Earth's magnetic field toward the poles. When they collide with atmospheric gases like oxygen and nitrogen, the atoms are energized and release light in vibrant colors, creating the aurora. This phenomenon also warms the polar ionosphere.

Bentley Subglacial Trench - is a vast topographic trench in West Antarctica. At 2,555 meters (8,382 ft) below sea level it (along with the deepest points within the adjacent Byrd Subglacial Trench) is among the lowest points on the surface of the Earth not covered by ocean, although it is covered by ice. Researchers from the University of Washington – St. Louis describe the bottom of the Bentley Trench as a "magma blowtorch".

Beta Decay - a type of radioactive decay where a beta particle (a high-energy electron or positron) is emitted from an unstable atomic nucleus. This process occurs when a neutron transforms into a proton, or vice versa, to achieve a more stable nucleus. In beta-minus decay (inverse beta decay), a neutron becomes a proton and an electron plus an anti-neutrino, while in beta-plus decay, a proton becomes a neutron and a positron plus a neutrino.

Bituminous Coal – also known as black coal, is a medium-rank coal widely used for electricity generation and steel production. It has a high heating value due to its high carbon content (45-86%) and is abundant, making it a key energy resource. Its primary uses are as thermal coal for power plants and metallurgical coal for making coke in steel production. The most likely source of bituminous coal is from abiotic hydrocarbon production. As bituminous coal resides under containment, heat and pressure it converts to anthracite coal.

Black Body Radiation (Stefan-Boltzmann Effect) – Black body radiation is the thermal electromagnetic radiation within, or surrounding, a body in thermodynamic equilibrium with its environment, emitted by a black body (an idealized opaque, non-reflective body). It has a specific continuous spectrum that depends only on the body's temperature.

Bridgemanite – the densest mineral known and the most abundant mineral in the world, comprising Earth's lower mantle, where it makes up about 70% of that layer. It is a high-pressure, high-temperature magnesium iron silicate of the perovskite family and its chemical formula is (Mg, Fe) SiO3. Bridgemanite is formed by the dehydration of Ringwoodite in the regions at the bottom of the Transition Zone and the top of the Lower Mantle (660 to 700 km down). This mineral transformation releases water and causes the slippage to produce the most powerful Richter 8 & 9 earthquakes. This source of water also reacts with SO3 to produce sulfuric acid and with SO2 to produce sulfurous acid, observed in volcanic discharges and hydrothermal vents.

Brownian Motion – is the random motion of particles or molecules suspended in a medium (a liquid or a gas). Molecules in air diffuse laterally by Brownian motion. They stratify vertically by convection or density (stratification).

Bulk Silicate Earth (BSE) – is the average chemical composition of Earth's mantle, crust, and lithosphere before the core formed. An example of silicate minerals is quartz, SiO2.

Byrd Subglacial Trench - is a vast topographic trench in West Antarctica. At 2,555 meters (8,382 ft) below sea level, it is among the lowest points on the surface of the Earth not covered by ocean, although it is covered by ice.

Campi Flegrei – is a large volcanic region west of Naples, Italy. The Neapolitan Yellow Tuff eruption (about 12ka BP) produced just 50 cubic kilometers. It is, however, one of relatively few volcanoes large enough to form a caldera. It is part of the Campanian volcanic arc, which includes Mount Vesuvius.

Carbonate Minerals – a group of minerals containing the carbonate ion (CO_3^-), with common examples including limestone, marble, dolomite, aragonite, and trona. Baking soda (sodium bicarbonate) is such a mineral and readily reacts with acids to produce CO and CO_2. Sulfur-bearing acids produced in the Lower Mantle flow up via mantle plumes and through reservoirs of molten carbonate minerals in the Upper Mantle to produce unmeasured amounts of CO_2. At a depth of 350 to 410 km, one molten carbonate reservoir centered on Yellowstone covers an area the size of Mexico and varies between 25 to 75 km thick. Researchers from the University of London estimate that if just 1% of this carbonate source decomposed to release CO_2, it would be equivalent to burning 2.3 trillion barrels of oil (S. Heir-Majumber, et al, 2017)

Champagne Vent – a deep-sea hydrothermal vent off the coast of Japan that releases gas-rich, high-pressure, LIQUID CO_2 that resembles champagne bubbles. CO_2 is produced in prodigious quantities within the Earth by sulfur-based acids decomposing carbonate minerals. Burning of carbonaceous fuels contributes an insignificant amount of total CO_2 to our atmosphere, which feeds photosynthesis.

Charon – In Greek mythology, the boatsman who rowed dead souls across the River Styx to the Underworld and is the root of the word chaos. Charon is also the name of the celestial body previously thought to be a moon of Pluto but from the New Horizons mission it is now known that Charon is about the same mass as Pluto and they form a binary planet system. They share a wispy atmosphere of pinkish tholins, the precursors to amino acids. The Great Red Spot of Jupiter is comprised of tholins.

Cherenkov Radiation - a blue glow caused by charged particles moving faster at the speed of light *in a medium*, such as water. When a charged particle exceeds this medium's light speed, it creates a shockwave of electromagnetic radiation, which appears as blue or violet light to the human eye. This is observed as antineutrinos strike positive matter. Cherenkov radiation imparts a faint bluish color in water-covered nuclear reactors or basins to cool spent nuclear reactor rods. A “scintillation” or blue flash of Cherenkov radiation is observed when an anti-neutrino strikes positive matter.

Chthonian planet – a type of celestial object formed when a gas giant or brown dwarf has its outer atmosphere stripped away by the gravity and stellar wind of a star, leaving behind its dense, rocky or metallic core. The name "chthonian" comes from the Greek word for "earth" or “clay” and refers to the deities of the underworld, which is fitting for a planet reduced to its scorching-hot core. Jan Mestan describes Earth as an early Chthonian planet. J. Marvin Herndon describes how the thermonuclear detonation of the Sun ripped off Earth’s gas/liquid proto-atmosphere.

Climategate - The "Climategate" scandal refers to the 2009 hacking of thousands of emails from the University of East Anglia's Climatic Research Unit. Critics used excerpts from the emails to allege that climate scientists manipulated data to exaggerate global warming. German publisher “Der Spiegel” produced a multipart series exposing Climategate in the spring of 2010.

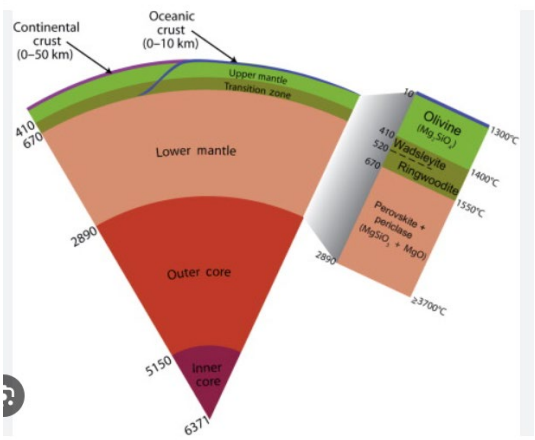
CNO Cycle – The CNO (carbon-nitrogen-oxygen) autocatalytic cycle is a series of nuclear fusion reactions that occur in stars more massive than the sun or in the latest stages of stellar life, following “Helium Flash”.

Confidence Level (Confidence Interval, Confidence Limit) - the probability that a statistical method will produce a confidence interval that captures the true population parameter. For example, a 95% confidence level means that if you were to repeat the sampling process many times, 95% of the confidence intervals you create would contain the true value. Two (2) Sigma (Two Standard Deviations) yields a Confidence Level of 95% which is the lowest value in a data set deemed to be “statistically significant”. One Sigma (one Standard Deviation) represents a Confidence Level of approx. 67%. One Sigma, one Standard Deviation, can be obtained by averaging a scatter plot. It is meaningless.

Contact Process (Sulfuric Acid Manufacture) – The contact process manufactures sulfuric acid in three main steps: burning sulfur to produce sulfur dioxide (SO2) followed by oxidizing SO2 to sulfur trioxide (SO3) with vanadium pentoxide (VO5) as a catalyst, then quenching SO3 in water to produced sulfuric acid (H2SO4). This process is exothermic (produces heat). This process occurs inside all major volcanic celestial bodies, with hematite (Fe2O3) serving as the catalyst.

Continental Drift - the theory that the Earth's continents have moved over geological time relative to each other, appearing to have "drifted" across the ocean bed. This movement is caused by the shifting of tectonic plates on the Earth's surface, driven by heat from the planet's core. This theory is fatally flawed when we understand that Tidal Pumping by the Sun’s gravity moves Earth’s tectonic plates. The Sun’s Tidal Pumping has pushed continental land masses into the Northern Hemisphere. With Tidal Pumping causing tectonic movement, all of the internal heat of the planet is delivered to the surface, and more specifically at the fissures in the ocean floor.

Core-Mantle Boundary (CMB) – Also known as D” (D double prime), the transition zone between the Earth's solid silicate mantle and its liquid iron-nickel outer core, located approximately 2,900 km below the surface. Per Paul Savage et al, approx.. 90% of the Earth’s sulfur resides at this level in the form of metal oxides (Pyrites, Fool’s Gold). Melting of the metal sulfides initiates the formation of sulfur-bearing acids, observed prominently in mantle plume volcanoes such as Yellowstone. Moreover, at D” perovskite minerals transition to post-perovskites, releasing heat and shrinking approx. 1.5% in volume.



Coriolis Effect - the apparent deflection of moving objects caused by the Earth's rotation, making objects appear to curve as they travel long distances. In the Northern Hemisphere, the deflection is to the right, causing winds and ocean currents to curve counter-clockwise, while in the Southern Hemisphere, it's to the left, resulting in clockwise rotation. This effect is strongest near the poles and weakest at the equator, and it influences large-scale weather patterns like hurricanes and cyclones.

Coronal Mass Ejection (CME) – a large eruption of plasma (cosmic rays, protons & Helium nuclei) and magnetic fields from the Sun's corona. These events can cause geomagnetic storms on Earth that disrupt power grids, satellites, and communication systems, but also create beautiful auroras. CMEs occur more frequently during the peak of the 11-year solar cycle and can range from slow-moving bubbles to fast-moving clouds that reach Earth in as little as 15 hours.

Coronal Volcano – a typical volcanic structure noted on Venus. Rather than a fumerole or chimney, a coronal volcano has a nearly circular low profile, similar to the bubbling features of a mud volcano. This same shape is noted in "petit-spot" volcanoes observed where major submarine plates subduct at trenches (Japan Trench). Such submarine volcanic structures emit significant amounts of CO2 and were extremely hard to detect until identified by Waseda University,

Correlation Coefficient - a statistical measure that quantifies the strength and direction of a linear relationship between two variables, with a value between -1 and +1. A positive value indicates a positive correlation (both variables increase together), a negative value indicates a negative correlation (one variable increases as the other decreases), and a value near zero means there is little to no linear relationship. The correlation between the solar cycle and Earth's climate is complex, with some studies showing a moderate-to-strong positive correlation ($r \approx 0.7 - 0.8$) in long-term trends of solar activity and Northern Hemisphere temperatures over specific historical periods.

Cosmic Rays – high-energy particles from space that bombard Earth, originating from sources like the Sun (solar cosmic rays) and distant astronomical events like supernova (galactic cosmic rays). They are composed of 90% protons, 9% Helium nuclei and other subatomic particles. They travel at nearly the speed of light. Earth's magnetic field and atmosphere deflect most of these rays, but some interact with the atmosphere to create a cascade of secondary particles that reach the ground.

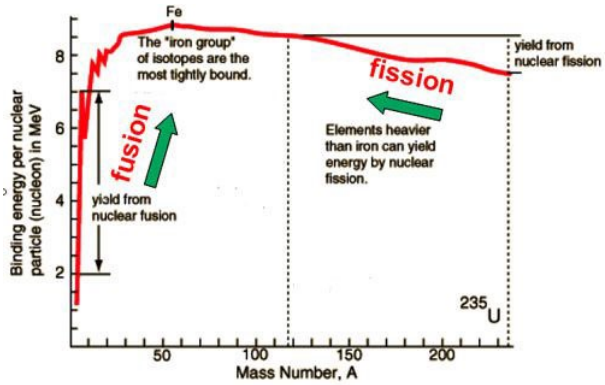
Craton - These are ancient, stable blocks of Earth's crust that form the core of continents and are composed of ancient crystalline basement rock and large section of a continent's crust, often with a deep "root" extending into the Earth's mantle. Their formation involves three main stages: initial crust formation, partial melting to create granite (TTG) rocks, and thickening through plate tectonic processes like accretion, subduction, and plume activity. They are economically important for their mineral deposits, such as diamonds. Superior Craton (North America), Amazonian Craton (South America), Kaapvaal Craton (Africa), North China Craton, Dharwar Craton (India), and Pilbara & Yilgarn Cratons (Australia).

Crocoite - a spiky/scaly Serpentine mineral consisting of lead chromate, $PbCrO_4$, and crystallizing in the monoclinic crystal system. It is identical in composition with the artificial product chrome yellow used as a paint pigment.

Crothers (Stephen) – an independent researcher and self-described "preeminent mathematician" known for his controversial and non-mainstream views on modern physics and cosmology. A former forensic investigator, he is a prominent critic of Albert Einstein's theories of relativity, the Big Bang theory, and the existence of black holes.

Curie Point (Curie Temperature) - the temperature at which a ferromagnetic material, like iron, loses its permanent magnetic properties and becomes paramagnetic, approx. 180 degrees Kelvin. This happens because thermal energy disrupts the alignment of the material's magnetic domains, causing it to cease being a permanent magnet and become only weakly attracted to a magnetic field. This phenomenon is named after physicist Pierre Curie.

Curve of Binding Energies – The curve of binding energies plots the average binding energy per nucleon against the atomic mass number, showing a peak at iron-56, which is the most stable nucleus. This curve illustrates why energy is released through both nuclear fusion (combining light nuclei to reach the peak) and nuclear fission (splitting heavy nuclei to reach the peak). For lighter elements, binding energy per nucleon increases with mass number, indicating greater stability. In essence, fission and fusion are natural counterparts in the Universe. See "The Fourth Source. Effects of Natural Nuclear Reactors" by Robert J. Tuttle as well as website "nuclearplanet.com" by J. Marvin Herndon.



Cyanobacteria – the earliest photosynthetic Life (bacteria) commonly known as blue-green algae. They emerged approx.. 3.5 billion years ago, which presents the Faint Young Sun Paradox. That is, at that time, the Sun was only 70% as luminous as today and the Earth should have been a frozen ball of ice, with no liquid water on the surface. However, with Tidal Pumping, Solar Maximums, and exothermic geochemical reactions, there was ample heat to maintain liquid water in the oceans. Cyanobacteria were also the starting point of mitochondria in cellular Life, formed via Endosymbiosis. Cyanobacetria were critical to the Great Oxidation Event which produced the oxygen-rich atmosphere we breathe today.

Dalton Minimum – a period of reduced solar activity from approximately 1790 to 1830/1840, characterized by fewer sunspots and a cooler global temperature. Named after English meteorologist John Dalton, it was a prolonged solar minimum during which sunspot numbers were about one-third of normal levels. While its sunspot counts were lower than average, they were still higher than those during the more extreme Maunder Minimum (1645 to 1715) and sunspots appeared in both solar hemispheres. The Dalton Minimum and Maunder Minimum span the Little Ice Age.

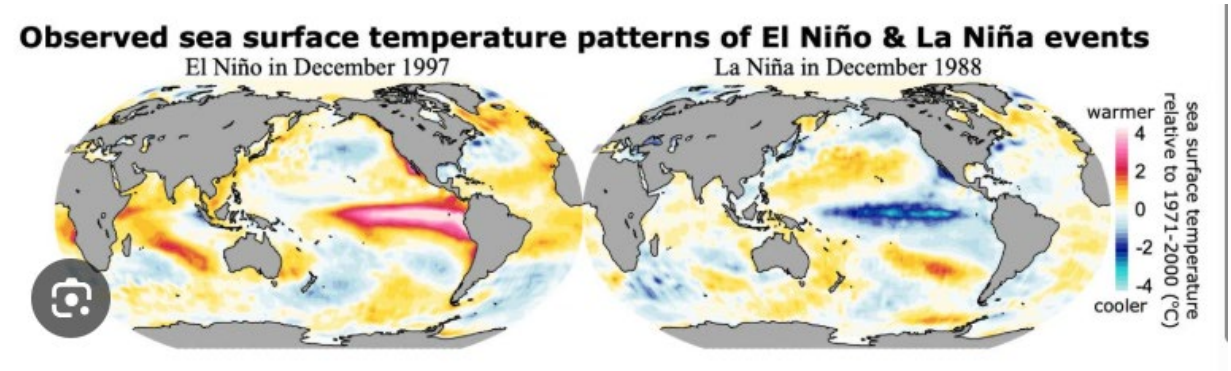
Electromagnetic Spectrum – the complete range of all types of electromagnetic radiation, which are waves of energy with electrical and magnetic fields. All EM waves travel at the speed of light in a vacuum, but they differ in their wavelength, frequency, and energy with gamma radiation as the highest frequency and highest energy. Extreme Low Frequency radio waves are used in submarine communications.

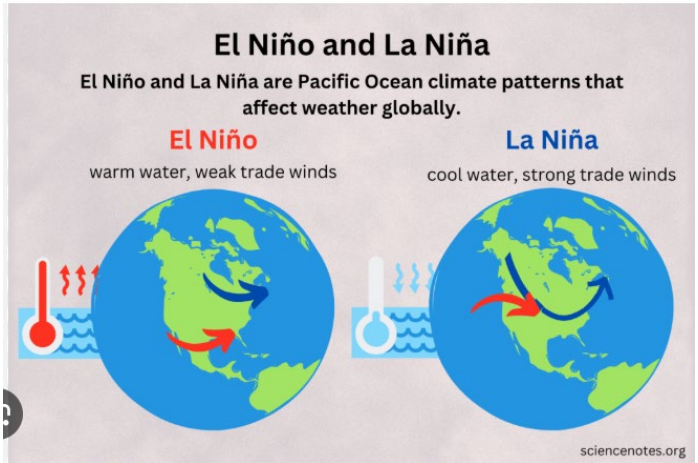
Electromotive Force (EMF) - the energy per unit of charge that drives electric current, synonymous with voltage and measured in volts. The EMF is what throws you across the room when you contact an energized conductor.

Electronegativity – the measure of an atom's ability to attract shared electrons in a chemical bond. This property is a chemical trend on the periodic table, generally increasing from left to right across a period and decreasing as you go down a group. The most electronegative element is Fluorine, while the least electronegative are Cesium and Francium.

Electropositivity – a chemical property indicating an atom's tendency to donate electrons and form a positive ion (cation). It is most evident in metallic elements like alkali and alkaline earth metals. Elements with high electropositivity possess low ionization energy, meaning minimal energy is needed to remove their outermost electron. Cesium (Cs) is the most electropositive stable element. The Lanthanides and Actinides are also very electropositive.

El Nino Southern Oscillation (ENSO) - a natural climate pattern of fluctuating sea surface temperatures in the tropical Pacific Ocean that impacts weather across the globe. It has three phases: El Niño, a warm phase with warmer-than-average ocean temperatures; La Niña, a cold phase with cooler-than-average temperatures; and a neutral phase where conditions are closer to normal. These phases disrupt normal wind and rainfall patterns, leading to various global effects like changes in precipitation and an increased risk of floods, droughts, and heatwaves. ENSO phases influence hurricane activity. For example, La Niña conditions in the Atlantic can lead to a more active hurricane season, while El Niño tends to lessen it.





Endosymbiosis – a relationship where one organism lives inside another, often with both benefiting. This symbiotic process is most famously exemplified by the endosymbiotic theory, which proposes that organelles like mitochondria and chloroplasts originated from free-living prokaryotic cells that were engulfed by a larger host cell and began to live in a mutualistic relationship. Cyanobacteria attached to larger amoeba and evolved into the mitochondria, the power house of cellular Life.

Energy – Energy is a function of Mass in Motion. Heat is Mass in Motion

- Einsteinian Physics (Release of the Strong Force, Fission, Fusion): E = mc2. Mass & Velocity
- Newtonian Physics (Gravity & Kinetic Energy): F = 1/2mv2. Mass & Velocity
- Planck's Law (Radiation): E = hf, where the Energy transmitted by radiation is a function of Planck's Constant (h) times the frequency (f). Radiation does not produce Energy. Radiation is the weakest form of heat transfer. Photons have no Mass. Whimsically, we can say that Photons have no Matter so they don't Matter.

Entropy – Energy flows from a point of higher potential to a point of lower potential. Water flows downhill. Heat flows towards a colder destination. It quantifies the energy in a system that cannot be used to do work. Higher entropy is often associated with more disorganized energy and matter within a system.

The Second Law of Thermodynamics states that the total entropy of an isolated system never decreases over time. Irreversible processes naturally increase the system's entropy until it reaches equilibrium, its state of maximum entropy. This law explains why certain processes are irreversible, such as an ice cube melting in a warm room.

The Greenhouse Gas Effect, alleging "trapping heat" and "back radiation" violates the 2nd Law of Thermodynamics.

Equilibrium – As applies to chemistry, equilibrium is expressed as the dynamic balance between a forward reaction and the reverse reaction. An example would be CO2 dissolved in water which exists in the equilibrium state of carbonic acid and the bicarbonate ion, which is a conjugate base or buffering agent to prevent large swings in pH (acidity). $CO_2 + H_2O \rightarrow H_2CO_3 \dashrightarrow\!\!< HCO_3^- + H^+$

Europa – a Tidally-pumped volcanic moon of Jupiter, suspected of harboring anaerobic life beneath ice sheets.

Eutectic - a mixture of two or more substances that has the lowest possible melting point of any combination of those substances. Mixtures of metals form eutectics. When heated, a eutectic mixture changes directly from a solid to a liquid at a single, specific temperature, known as the eutectic temperature. Eutectics have very high surface tension. Radiogenic heat from heavy elements in enstatite chrondites contributed to partial melting and enhanced the initial accretion process of planetary cores.

Expansion Tectonics - the Expanding Earth theory, is a hypothesis that explains the movement of continents by the growing volume of the Earth over geologic time. New crust has been added by the upwelling of new mass at divergent or rifting zones such as the Galapagos Triple Junction. Expansion Tectonics is explained by Tidal Pumping and the expanding gases and liquids produced by geochemical reactions. Adherents include Ott Hilgenberg, Samuel Carey, James Maxlow, Ian Plimer, Giancarlo Scalera, Jan Mestan, and J. Marvin Herndon. James Maxlow's book: "Beyond Plate Tectonics".

Faint Young Sun Paradox – the puzzle of how early Earth remained warm enough for liquid water and photosynthetic Life (Cyanobacteria) to exist when the young sun was about 30% less luminous than it is today. The Earth should have been a solid block of ice. Tidal Pumping by the Sun's gravity, exothermic geochemical reactions, and the energy of cosmic ray bombardment heating Earth's ionosphere were unknown when the Faint Young Sun Paradox was promulgated.

Fault (especially Transform Fault) - describes the movement of tectonic plates sliding horizontally past one another, creating transform plate boundaries. These boundaries are characterized by strike-slip faults that connect other plate boundaries, such as divergent or convergent ones. The San Andreas Fault is a famous example where the Pacific Plate grinds against the North American Plate, pushing the North American plate northwards.

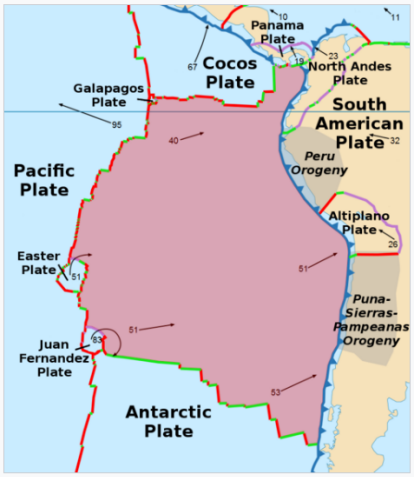
Fischer-Tropsch Reactions – a well-known hydrocarbon reaction: CO + H2, at approx. 350 C and in the presence of an Iron or Cobalt catalyst produces methane (CH4) and water. Left to dwell, the same process builds upon the methane to produce longer chain hydrocarbons (oil). Within the Earth, the mineral transformation of Serpentinization produces Hydrogen and the acidic decomposition of carbonate minerals produce CO and CO2. All of these reactions are exothermic (produce heat). See Serpentinization and Sabatier reactions

Flash Chemistry – a technique that uses microreactors and fast-moving reagent streams to conduct extremely fast organo-synthesis reactions under highly controlled conditions. By controlling the reaction time down to milliseconds, it allows chemists to work with unstable, highly reactive intermediates that would be impossible to control in a traditional flask or "batch" reactor. Flash chemistry would be a logical mechanism to replicate complex RNA molecules in the passages of hydrothermal vents, i.e. the precursor to RNA and DNA replication.

Fossil fuels – the colloquial term to describe carbonaceous fuels. In fact, there are only two (2) "fossil fuels" – lignite coal produced from fern bogs coated over by volcanic pyroclastic ash and Kerogens, produced by algae and phytoplankton wedged into shale formations. Both of these fuels are low sulfur. Lignite coal is abundant in Wyoming, with Yellowstone as the source of pyroclastic ash. The Bakken Formation of the Dakotas is comprised of Kerogens, a light sweet crude which commands a premium on world markets. Carbonaceous fuels which contain sulfur are produced from abiotic mechanisms such as Fischer-Tropsch and Sabatier reactions. Earth will produce abiotic hydrocarbons for hundreds of millions, perhaps billions of years.

Fumarole - an opening in the Earth's surface that emits steam and volcanic gases. The name comes from the Latin word *fumus*, meaning smoke. These vents are characteristic of volcanic areas and can be found near active volcanoes, in craters, or on the surface of new lava and pyroclastic flows. Fumaroles of ice are also produced where volcanic steam melts through Antarctic ice sheets.

Galapagos Islands – a volcanic archipelago in the Pacific Ocean, belonging to Ecuador, site of the Galapagos Triple Junction or Galapagos Hot Spot. The Galapagos Triple Junction is a three-way divergent point where the Cocos plate, Nazca plate, and Pacific plate are pulling apart. Upwelling magma forms new crust. This junction is the source of the annual El Nino. Seismic heat release drives deep water anchovies to the surface and provides a bonanza for the fishermen of Equador and Peru, right around Christmas. “El Nino”. A Gift from The Child.



The Galápagos microplate is forming at the triple junction of the Nazca (shown in pink), Cocos, and Pacific plates

Galactic Tidal Forces – A galactic tide is a tidal force experienced by objects subject to the gravitational field of a galaxy such as the Milky Way. Particular areas of interest concerning galactic tides include galactic collisions, the disruption of dwarf or satellite galaxies and the Milky Way's tidal effect on the Oort Cloud of the Solar System. Such tidal forces can affect Earth as the Solar System passes by Radcliffe Waves or Black Dwarfs.

Ganymede – a Tidally-pumped volcanic moon of Jupiter

Georeactor – the hypothetical terracentric fast neutron breeder reactor at the core of the Earth and almost all major planets. Nuclear fission being the ignition source of fusion in stars. See J. Marvin Herndon and www.nuclearplanet.com and “The Fourth Source. Effects of Natural Nuclear Reactors” by Robert J. Tuttle.

Gravity Wave – "Gravity waves" can refer to either gravitational waves in spacetime, predicted by Albert Einstein and caused by cosmic events like merging black holes, or gravity waves in Earth's atmosphere, which are ripples in the air caused by disturbances like thunderstorms or wind blowing over mountains. Gravitational waves are distortions of spacetime that stretch and squeeze it as they pass, while atmospheric gravity waves are weather phenomena that can cause turbulence and are visible as cloud patterns.

Greenhouse Gas Effect - a natural process where gases in the atmosphere, like water vapor, trap heat from the sun, maintaining warmth at the Earth's surface and making it habitable. Due to hydrogen-bonding and the enormous heat capacity of water, water is the only thermodynamically significant molecule in our atmosphere. We do not exist inside an enclosure of glass panes. We live beneath a patchy blanket of clouds with warm, moist air below and cold, dry air aloft. Low clouds control Earth’s temperature (Kauppinen & Malmi, University of Turku, Finland, 2019).

Gyre - Ocean gyres are large systems of rotating ocean currents, driven by global wind patterns and the Coriolis effect. These currents move clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. The five major gyres are the North Atlantic, South Atlantic, North Pacific, South Pacific, and Indian Ocean gyres. The gyre of the South Pacific travels from east to west just south of the Equator and is significant for the trade winds and the El Nino.

Hadley Cell – a large-scale atmospheric circulation pattern where warm, moist air rises at the equator, moves toward the poles at high altitudes, and then sinks in the subtropics (around 30° North and South latitude). Viewed from a western vantage point, the Northern Hemisphere Hadley cell circulates in a counterclockwise rotation. See also Mid-latitude cell (30 degrees to 60 degrees latitude) and Polar cell (60 degrees to 0 latitude).

Hematite – Fe2O3. One of the simplest forms of Iron oxide (rust). A catalyst in the contact process for sulfuric acid.

Henry's Law – Henry's law states that the solubility of a gas in a liquid is directly proportional to the partial pressure of that gas above the liquid. This is in evidence as warmer Equatorial waters de-gas CO2. Far greater CO2 is dissolved into ocean waters than the CO2 in our atmosphere.

Herndon (J. Marvin) – James Marvin Herndon is an American interdisciplinary scientist known for his alternative and controversial theories in geophysics, cosmochemistry, and climate science, most notably for his concepts of the GeoReactor and planetary expansion (Whole Earth Decompression Dynamics).

H Phase Iron – refers to an HCP (hcp) phase of iron or an iron hydride (Fe-H) phase. The hcp phase is a stable crystal structure of iron under certain high-pressure conditions, while Fe-H phases are formed when hydrogen is incorporated into the iron lattice. These can exist as different hydride phases, including a high-pressure hcp iron hydride. H phase Iron exists at the Core-Mantle Boundary.

Hot Spot (Tectonics, Volcanism) – There are about 40 to 50 "hot spots" globally, including mantle plume volcanic regions, which heat the ocean waters. Galapagos Hot Spot, the Tonga Trench, Hawaii, Iceland, Gulf of Maine, Gulf of Guinea, Samoa, Melbourne, Campi Flegrei, Mt. Erebus (Antarctica), Yellowstone. This alone gives a lie to "Climate Modelling" where heat is more or less uniformly distributed in the gases of the atmosphere. Geothermally-heated oceanic hot spots drive our weather patterns.

Hummock – Small hillocks of ice formed in ice sheets, especially in Antarctica, where volcanic hot spots inject steam into the ice sheet, the steam freezes and expands, producing the hummock. Ice accumulates, adding to the Antarctic ice mass.

Hydrogen Bonding - the attraction between a hydrogen atom, covalently bonded to a highly electronegative atom like nitrogen, oxygen, or fluorine, and another electronegative atom in a neighboring molecule. Hydrogen bonding gives water its tremendous heat capacity.

Ideal Gas - is a hypothetical gas composed of randomly moving, point-sized particles that have no intermolecular forces and undergo only perfectly elastic collisions. Although no real gas is truly ideal, many gases behave in an ideal way under conditions of high temperature and low pressure, making the ideal gas model a useful approximation. This behavior is described by the ideal gas law, PV = nRT

Inverse Piezoelectric Effect – The piezoelectric effect is observed when quartz crystals are subjected to mechanical stresses resulting in a small electric charge. This is how crystal radio sets work. The inverse piezoelectric effect occurs when positively charged cosmic rays of sufficient energy penetrate Earth's magnetic field and strike quartz (silicate) rock formations. Such shallow rock formations exhibit mechanical stress and deform, causing rock slides.

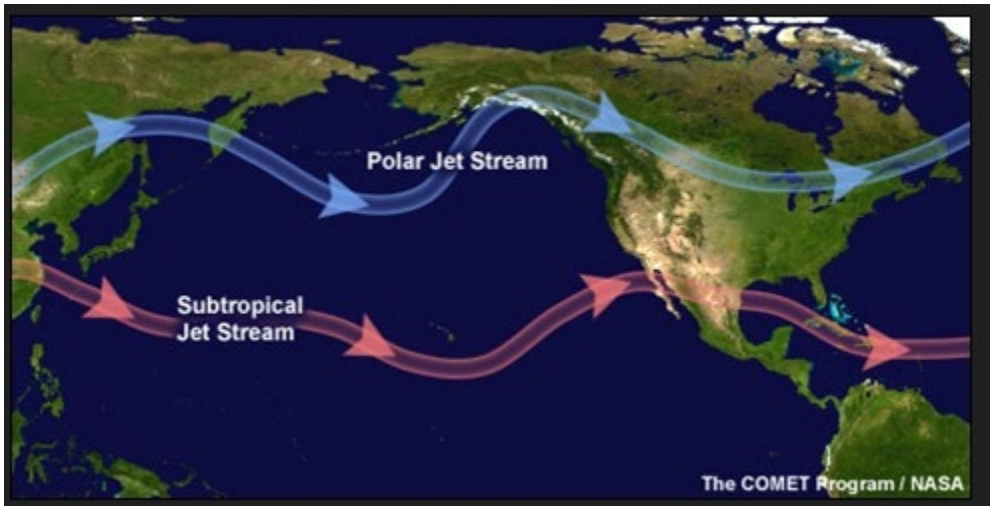
Io – A tidally-pumped moon of Jupiter. The most volcanic celestial body in the solar system.

Ionizing Radiation – Higher frequency radiations such as gamma rays, X-rays, and Ultraviolet can knock an electron out its orbital to cause chemical reactions. Ultraviolet radiation stimulates melanin pigment and produces a tan. Visible light drives photosynthesis. Longer wavelengths cannot disrupt co-valent bonds but infrared and microwaves can disrupt the hydrogen bonding in water and cause boiling.

Ionosphere – a region of the upper atmosphere, extending from about 50 km to 2,000 km above Earth's surface, that is partially ionized by solar radiation. The solar wind striking the ionosphere causes the Aurora Borealis. More prominent aurora borealis are observed with coronal mass ejections. Even more, these most powerful particle streams heat the ionosphere to destabilize the polar jet stream into a wave-like motion, resulting in flooding precipitation, heat domes, and cold fronts.

Jacobshavn Glacier - is located on the west coast of Greenland flowing out into the Davis Strait. It is one of the fastest-flowing glaciers in the world. The base of the glacier is at or below sea level and is a gravel bed caused by abrasion/erosion of the rock. The interior of Greenland is seismically heated to produce channels of subglacial melt water. The ice mass of Greenland's interior is hydraulically connected to the sea such that it has already displaced its equivalent mass (Archimede's Principle).

Jet Stream – a high-altitude, narrow band of strong wind that generally flows from west to east around the globe, driven by temperature differences between air masses. The two main types are the polar jet stream and the subtropical jet stream (Pacific jet stream) which form where colder polar air meets warmer air near the poles and subtropics, respectively. These "rivers of wind" can influence weather patterns by steering storms and can shift position and strength with the seasons. In an El Nino, a warm convection cell (low pressure) sets up along the central Pacific which draws the Pacific jet stream further south to blow along the latitudes where tropical storms form off North Africa. As such, Atlantic hurricanes are suppressed during an El Nino. The opposite occurs during a La Nina.



Jupiter – Fifth planet from the Sun, and the largest planet. Jupiter's mass is 2.5 times larger than the masses of all other planets combined. The Sun and Jupiter provide the barycenter of the solar system, the moving center of gravity.

Kelvin – Temperature scale measured in degrees Celsius, but based upon Absolute Zero (- 273.15 C)

Kepler (Johannes) – a German astronomer and mathematician known for his three laws of planetary motion. His work proved Nicolaus Copernicus's heliocentric theory and provided the mathematical basis for Isaac Newton's law of universal gravitation.

Kerogens - insoluble, solid organic matter found in sedimentary rocks, formed from the compressed remains of algae and phytoplankton. When subjected to heat and pressure, kerogen breaks down into liquid and gaseous hydrocarbons like oil and natural gas. Kerogens are typically found in shale formations such as the Bakken formation of the Dakotas. Kerogens are a light, sweet (low sulfur) oil which command a premium in world markets.

Lanthanides – a group of 15 rare earth metals with atomic numbers 57 through 71, found in the first row of the two separate rows at the bottom of the periodic table. The typical fission of Uranium produces Ruthenium and Neodymium.

Laser Interferometer Gravity Observatory (LIGO) – measurement technology to sense the distortion of space-time caused by a passing gravitational wave, which are ripples in the fabric of space-time itself. LIGO measures ripples in space-time the width of a proton.

Lattice Confinement Fusion – a method of nuclear fusion that embeds hydrogen isotopes within a metal lattice, using electron screening to lower the energy needed for fusion. Unlike conventional fusion approaches that use intense heat or magnetic fields, LCF creates a fusion-level kinetic energy environment on a microscopic scale within a solid material at room temperature. Pierre-Marie Robitaille describes that stars conduct fusion in this manner, with a metal lattice of solid hydrogen, a form of condensed matter.

Le Chatelier's Principle (Reversible Reaction) - if a system at equilibrium is subjected to a change in temperature, pressure, or concentration, the system will adjust to counteract the change and re-establish a new equilibrium. CO_2 dissolved in water exists in a state of equilibrium, shifting between carbonic acid (H_2CO_3) and the bicarbonate ion (HCO_3^-). The bicarbonate ion is a buffering agent or conjugate base. It prevents broad swings in pH.

Lenz's Law – the direction of an induced electric current in a conductor is such that the magnetic field it creates opposes the change in magnetic flux that produced it. Stated another way, every time a charged particle moves, it generates a magnetic field. Lenz's Law is a qualitative statement. Maxwell's Equations are the quantitative derivation.

Lignite – Also known as brown coal, soft coal, or thermal coal (used in power plants) , lignite is produced from fern bogs that were coated over by volcanic pyroclastic ash – much the same as charcoal is produced in an oxygen-deprived wood kiln. Lignite is approx. 65% Carbon value, low sulfur content, and found in shallow deposits that are cheaply mined by strip mining. Ample deposits are found in Wyoming.

Loess – a wind-blown silt that forms highly porous, yellowish-gray sediment, often containing clay and calcium carbonate. It can be found in large deposits around the world, such as in the Chinese Loess Plateau and the American Midwest, and is known for being fertile but also highly susceptible to erosion when wet.

Luna 1 Mission - the first to directly detect the solar wind in January 1959, followed by NASA's Mariner 2 in 1962, which confirmed the findings.

Mafic & Ultramafic Minerals - igneous rocks distinguished by their low silica content and high proportion of iron and magnesium. Mafic rocks are rich in minerals like plagioclase, have a silica content of 45-55%, and are typically dark in color (e.g., basalt and gabbro). Ultramafic rocks contain even more magnesium and iron, with silica content below 45%, and are dominated by olivine and pyroxene (e.g., peridotite). These minerals are transformed by water in the serpentinization process to produce hydrogen. Serpentinization is exothermic.

Magnetite – a strongly magnetic iron oxide mineral (Fe_3O_4) that is black, has a metallic luster, and is often used as a source of iron for steel production. Historically, naturally magnetized pieces of magnetite called lodestones were used to create the first magnetic compasses

Mantle Plume Volcano – a column of hot, rising magma from deep within the Earth's Lower Mantle that creates a hotspot on the surface, leading to volcanic activity that is not necessarily at a tectonic plate boundary. As the tectonic plate moves over the stationary mantle plume, a chain of volcanoes is formed, with the youngest and most active volcano being over the plume itself. The Hawaiian Islands and Yellowstone are well-known examples of volcanoes formed by mantle plumes.

Mariner 2 mission - the first successful U.S. interplanetary spacecraft, launched by NASA on August 1962, to explore Venus. It completed its mission on December 1962. Mariner 2 confirmed the existence of the solar wind, first detected by the Soviet Luna 1 spacecraft in 1959.

Mars – Fourth planet from the Sun. Mars can affect Earth's orbit through its gravitational pull, causing tiny but cumulative changes that create a 2.4-million-year cycle of orbital shifts. While these changes are small, they can alter Earth's climate over long periods by inducing minor Tidal Pumping effects and slightly changing the amount of solar radiation Earth receives.

Maunder Minimum – a period of greatly reduced solar activity that lasted for about 70 years, from approximately 1645 to 1715. During this time, sunspots—temporary regions of intense magnetic activity on the sun's surface—became exceedingly rare. This minimum coincided with one of the coldest phases of the "Little Ice Age" and led to a slight but significant cooling of Earth's Northern Hemisphere.

Maxwell's Equations - a set of four coupled partial differential equations that describe how electric and magnetic fields are generated and altered by each other and by charges and currents. They form the foundation of classical electromagnetism, optics, and electric circuits.

Messenger Mission – The MESSENGER (MErcury Surface, Space ENvironment, GEochemistry, and Ranging) mission was a NASA robotic space probe that became the first spacecraft to orbit and study the planet Mercury. Launched in 2004 and completed in 2015. Observed geysers of hydrogen venting from Mercury as well as water ice in deep gullies at Mercury's North Pole.

Mid-Atlantic Ridge – a massive underwater mountain range that runs down the center of the Atlantic Ocean, from the Arctic to near Antarctica. It is the most well-known example of a divergent plate boundary, where Earth's tectonic plates are pushing apart and new crust is forming.

Mid-Latitude Cell – also known as the Ferrel cell, is a major atmospheric circulation pattern that operates between approximately 30° and 60° latitude in both the Northern and Southern Hemispheres. It is a component of the global air circulation model, along with the Hadley and Polar cells. Viewed from a western vantage point, the Northern Hemisphere's Mid-Latitude cell circulates in a clockwise direction. The N. Hemisphere Hadley cell and polar cell rotate counterclockwise.

Milankovitch Cycles - long-term, natural changes in Earth's orbit and tilt that affect the amount of solar energy received, influencing long-term climate shifts like Ice Ages and Interglacial Periods. The three main components are orbital eccentricity (the shape of Earth's orbit), obliquity (the tilt of the axis), and precession (the wobble of the axis). Regarding climate changes, the significance of Milankovitch cycles is the Tidal Pumping effects. Solar irradiance is far less significant. Orbital eccentricity is also affected by the gravity of Venus, Mars, and Jupiter.

Mount Erebus – the world's southernmost active volcano, located in West Antarctica. The ice-covered stratovolcano is known for a rare, persistent lava lake in its summit crater that has been active since at least 1972. Mount Erebus is one of approx. 40 to 50 prominent global "hot spots".

New Horizons Mission – launched in 2006, a NASA space probe that conducted the first reconnaissance of Pluto and its moons before venturing deeper into the Kuiper Belt. This mission identified that Charon is not a moon of Pluto. Rather, Charon and Pluto are about equal mass and they form a binary dwarf planet system, orbiting around one another and sharing a thin wispy atmosphere of "tholins", the complex hydrocarbons which are the precursors to amino acids. Jupiter's Great Red Spot is comprised of tholins. Note that prior to the New Horizons mission, TV personality Neil de Grasse Tyson derided Pluto as a "disinteresting rock" and led the move to demote Pluto as a planet. Well, Neil de Grasse Tyson is a "disinteresting rock". Call up the video of Stephen Colbert's interview with Neil de Grasse Tyson regarding Pluto.

Ninety East Ridge – a long, linear underwater mountain chain in the Eastern Indian Ocean, named for its location along the 90th meridian East. It is the longest such ridge on Earth, stretching for about 5,000 km, and was formed by hotspot volcanism as the Indian tectonic plate moved northward over the Kerguelen mantle plume, creating a volcanic "trail". This ridge also marks part of the diffuse, seismically active boundary between the Indian and Australian tectonic plates. Ninety East Ridge is on the opposite side of the world from the Galapagos Triple Junction (Galapagos Hot Spot) at approx. longitude 90 degree West.

Obliquity - the angle or tilt between a planet's rotational axis and its orbital plane**,** a phenomenon that relates to the seasons on Earth. Obliquity is one of the Milankovitch cycles. It varies from 24.5 degrees to 22.1 degrees over a 41,000 year cycle. Currently, our Obliquity stands at 23.4 and is headed towards the smaller value.

Olivine – (Mg, Fe)2 - SiO4. One of the most prominent ultramafic minerals which can transform when exposed to water to produce hydrogen and a serpentine mineral, so noted due to its scaly surface appearance.

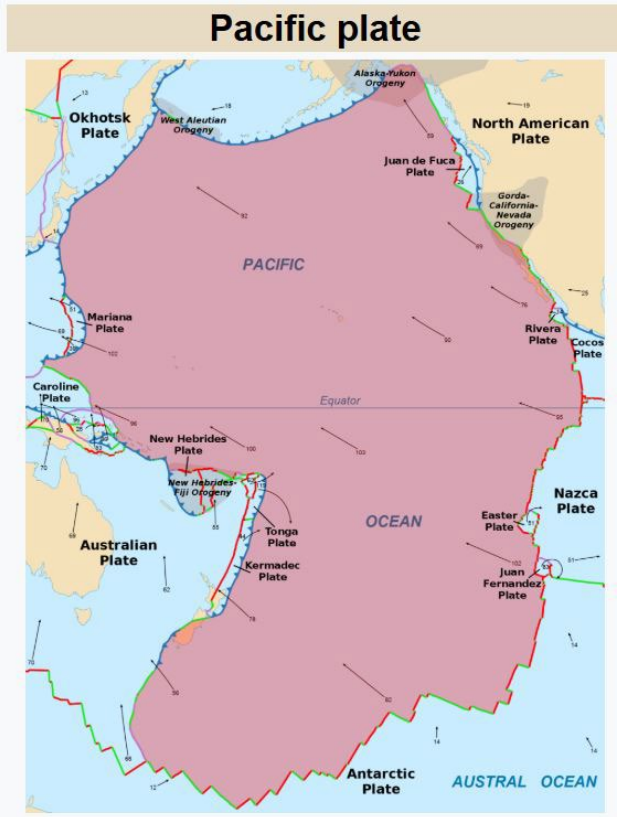
Orbital Eccentricity - a dimensionless parameter that measures how much an object's orbit deviates from a perfect circle. A value of 0 indicates a perfect circle, while higher values signify a more elongated, elliptical orbit. Eccentricity is one of the key orbital elements that defines the shape of a celestial body's path. Orbital eccentricity is one of the Milankovitch cycles. It is correlated to solar irradiance but of greater significance is the elongation of our orbit producing a closer approach to the Sun in the perihelion, affecting the Tidal Pumping effect. Venus and Jupiter have significant influence on Earth's orbital eccentricity; Mars somewhat less so.

Orogeny – Mountain building. A process in which a section of the earth's crust is folded and deformed by lateral compression to form a mountain range. Examples: The Indian plate subducts beneath the Eurasian plate to form the Himalayas. New crustal mass (magma) wells up at the divergence between the Pacific plate and the Nazca plate, shoving the Nazca plate eastward to subduct beneath the South American plate to form the Andes.

Oort Cloud – a spherical shell of icy debris that surrounds our solar system at its outermost reaches, beginning between 2,000 and 5,000 astronomical units (AU) from the Sun. It was likely formed from leftover material from the solar system's formation, which was scattered by the early planets.

Ozone – Triatomic Oxygen (O3). Form of Oxygen formed by solar radiation disassociating O2 in the upper atmosphere to recombine into O3. Ozone is unstable is unstable and decay back to O2, but enough is present in the atmosphere to filter high frequency Ultraviolet Radiation. Ozone does not form in the sunless polar winters. It is at its minimum at the polar spring. The solar wind and cosmic rays continuously strip off ozone over the polar regions where the protective magnetic field does not extend.

Pacific Plate – Earth's largest tectonic plate dragged from Southeast to Northwest by the Sun's Tidal Pumping forces. Observe the direction of the arrows in the image below. Divergence along the East Pacific Rise and the Galapagos Triple Junction allows upwelling magma to warm the waters of the El Nino. New crust is formed, pushing the Cocos plate to subduct beneath the Caribbean plate and Nazca plate to subduct beneath the South American plate. At the Tonga Trench in the western Pacific, the Pacific plate subducts beneath the Australian plate, pushing it northwards. Plate fractures and faults extend to the west of Papua New Guinea. Warming of these waters drives the La Nina and the annual monsoons of Southeast Asia. The South Pacific gyre and trade winds strengthen.



Perigee - the point in an object's elliptical orbit where it is closest to the celestial body it is orbiting. The perihelion specifically describes planetary position at its closest approach to the Sun. For the Earth, the perihelion occurs on approx. Jan. 3 or 4.

Perovskites (& Post-Perovskites) – the Earth's Lower Mantle is comprised of perovskites ((Mg, Si) O3). Post-perovskite is mineral phase that forms from perovskite under extreme pressure, such as at the base of Earth's lower mantle, and is characterized by a different crystal structure and properties like higher electrical conductivity. The conversion is exothermic (produces heat). This transition is geophysically significant because it can explain observed seismic discontinuities in the D'' layer, the region just above Earth's outer core. The heat also contributes to melting of metal sulfides to release sulfur. Molten sulfur begins the chain of exothermic geochemical reactions to produce all the sulfur-bearing acids observed in mantle plume volcanoes.

Petermann Glacier - a large, marine-terminating glacier in northwest Greenland that connects the Greenland ice sheet to the Arctic Ocean. Its floating ice tongue is the longest in the Northern Hemisphere. The base of the glacier is at or below sea level and is a gravel bed caused by abrasion/erosion of the rock. The ice mass of Greenland's interior is hydraulically connected to the sea such that it has already displaced its equivalent mass (Archimede's Principle).

Petit Spot Volcanoes – small, underwater volcanoes formed by the bending of a tectonic plate as it is subducted (pushed) under another plate. Observed along trench systems. Unlike classic volcanoes that form at plate boundaries or "hotspots" like Hawaii, petit-spot volcanoes form near subduction zones in a process caused by plate flexure. They not small. Rather, they are hard to detect because they do not build into a chimney or fumarole. Rather, they are more like sources of lava flood plains, oozing out carbonate minerals, CO2, and methane.

Phytoplankton - microscopic, plant-like organisms and bacteria that form the base of the food web in nearly all marine and freshwater environments. The key differences are that phytoplankton are microscopic and account for about half of Earth's photosynthesis, with faster turnover rates, while terrestrial plants are larger and have a longer life cycle. Phytoplankton are also more directly tied to global carbon cycles. Plankton "sequester" CO2 in carbonate mineral deposits such as limestone, marble, and trona while land-based photosynthetic biomass is consumed in microbial and fungal decomposition.

Piezoelectric Effect - The piezoelectric effect is observed when quartz crystals are subjected to mechanical stresses resulting in a small electric charge. The piezoelectric effect is observed in crystal radio sets. See Inverse Piezoelectric effect.

Planck's Law – describes the electromagnetic radiation emitted by a black body at a given temperature, explaining that energy is radiated in discrete packets called quanta. Developed by Max Planck in 1900, the law resolved the "ultraviolet catastrophe" by postulating that energy is quantized, not continuous, and can only be emitted or absorbed in multiples of hf, where "h" is the Planck constant and "f" is frequency

Precession of the Equinoxes - a slow wobble of Earth's rotational axis that causes the position of the equinoxes to shift over a cycle of about 26,000 years. This wobble is caused by the gravitational pull of the Sun and Moon on Earth's equatorial bulge. Precession of the Equinoxes provides our seasons and is one of the Milankovitch cycles, a significant variable in Tidal Pumping.

Pyroxine – a group of dark, iron- and magnesium-rich silicate minerals that are defining components of mafic rocks. The term “mafic” describes the chemical composition of igneous rocks that are rich in these ferromagnesian minerals and low in silica. Mafic rocks are typically dark-colored and dense. Exposed to water, pyroxine produces hydrogen and yields one of the serpentine minerals.

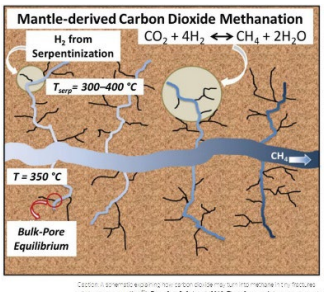
Radcliffe Waves - a large-scale galactic structure that may have influenced Earth's climate by causing the solar system to pass through it approximately 14 million years ago. This passage likely compressed the heliosphere, allowing more interstellar dust and cosmic particles to enter Earth's atmosphere, which could have contributed to the Middle Miocene Climate Transition, a period of significant cooling and ice sheet growth. However, some scientists remain skeptical, suggesting terrestrial factors are the more probable cause of major climate shifts.

Rao (M.A. Padmanabha) – Indian nuclear physicist (1937 - 2020, a personal friend). Ten Fundamental Discoveries in Nuclear Physics, X-ray Physics, Atomic Spectroscopy, Solar Physics, Special Theory of Relativity, and Planetary Temperature reported in 2010, 2013 and 2015 in six research papers, including “Discovery of Self-Sustained 235-U Fission Causing Sunlight by Padmanabha Rao Effect” (2013). That is, solar flares are nuclear fission events.

Right Hand Rule – A useful visualization of electromagnetism. Extend your right hand with the thumb up, the forefinger extended and the remaining three digits curled around. Visualize the electrical current flowing from the base of your palm out through your thumb. The three curved fingers represent the lines of magnetic flux, produced by the flow of electrons. The extended forefinger represents the Electromotive Force (EMF), the force that blows you across the room.

Ringwoodite – a high-pressure mineral (Mg2-Si) - O2 , a polymorph of olivine (Mg, Fe)2 - SiO4, that exists in at the bottom of Earth's mantle transition zone (520-660 km deep). It is significant because its crystal structure can absorb water molecules, trapping them as hydroxyl radicals (OH). This mineral is key to understanding the "deep water cycle" of Earth and has confirmed the existence of vast water reservoirs beneath the surface. when it is forced deeper into the mantle, where higher pressure causes it to partially melt in a process called dehydration melting. As Ringwoodite moves from the mantle's transition zone to the lower mantle, it transforms into a different, higher-pressure mineral called Bridgemanite, a silicate perovskite which cannot hold water. This causes the bound water to be released, leading to partial melting in the rock at the boundary between these zones. It is estimated that the Ringwoodite layer contains 3x amount of water than in the Earth’s oceans.

Sabatier Reactions - Under reducing conditions, at approx. 350 C, and in the presence of a Nickel or Alumina catalyst Sabatier reactions proceed: CO2 + H2 → CH4 (methane) + H20 (water). Left to dwell with a supply of reagents, more complex hydrocarbons (oil) build out from the methane. This is the basis for abiogenisis (abiotic hydrocarbons) produced on all planets. Sabatier reactions are exothermic. See also Fischer-Tropsch reactions and Serpentinization. See “Deep Carbon, Past to Present”, Chapter 12.



Scotia Plate – tectonic plate extending east from the tip of South America. The Scotia plate and Antarctic plate form a convergence or pivot point for movement of the Antarctic plate in a slightly northeasterly rotation.

Serpentinization (Serpentine Minerals) – The transformation of a mafic or ultramafic mineral such as olivine by simple exposure to water which releases hydrogen and produces a Serpentine mineral, so named due to its scaly appearance. Serpentinization is an exothermic process. See also Fischer-Tropsch and Sabatier reactions.

Sigma Value – A statistical measure of Standard Deviations, assuming a symmetric bell curve data distribution. One Sigma (one Standard Deviation) is the mean value of a data set and captures 67 % of the data under the bell curve. Two Sigma captures 95% of the data points under a bell curve and it is considered the bare minimum for consideration as "Statistically Significant".

Silica – Silicon dioxide (SiO2). Quartz sand or sandstone. Silica is considered a good catalyst support as it is porous, allowing reagents to penetrate into the mineral and contact a catalyst such as alumina, which is the catalyst for Sabatier reactions. Petroleum is typically found in regions with sandstone, such as continental shelves.

Social Science Research Network (SSRN) – a "pre-print" publishing site. Part of the Elsevier publishing group. I have published in SSRN.

Solar Cycle – an 11 year cycle of solar activity, marking a solar pole reversal. First observed in 1755 to 1766 (Solar Cycle 1). Solar Maximums produce solar geomagnetic storms and coronal mass ejections of solar plasma (cosmic rays). It is hypothesized that Tidal Pumping effects of the alignment of Venus, Earth and Jupiter causes the 11 year Solar Cycle. The Solar Cycle causes our 11 year weather disruption. That is, the alignment of Venus, Earth, and Jupiter cause plasma tides on the Sun, solar storms, and solar magnetic pole reversals. See Maunder & Dalton Minimums.

A powerful Solar Maximum emerged in 2024 with violent coronal mass ejections, aurora borealis, and heating of the polar ionosphere. The polar Jet Stream is kicked into a wave pattern with fast-moving low pressure centers descending into the mid-latitudes delivering flooding rains (wiping out crops). At the bottom of the trough, a blocking high pressure center forms a heat dome (droughts, cattle herds suffer, filet mignon at $30 per pound). Then the ascending wave provides a cold front as the cold front moves from west-to-east.

Stability of the Solar System - The stability of the solar system is a complex issue; while it appears stable over human timescales, it is technically chaotic over millions of years. Gravitational interactions between planets, especially in the inner solar system, introduce small-scale instabilities that, over vast periods, could theoretically lead to catastrophic events like planetary collisions or ejections.

Stefan-Boltzmann Effect (Black Body Radiation) – describes how the total energy radiated from a surface is related to its temperature, stating that the power per unit area is proportional to the fourth power of the absolute temperature.

Sunda Sea Triple Junction - a complex tectonic area in Southeast Asia where the Sunda (Eurasian), Australian, and Philippine Sea converge. The regions stretching between the Tonga Trench and Sunda Sea Triple Junction mark the seismically-heated waters that drive the La Nina.

Sun Spots – geomagnetic solar storms accompanied by coronal mass ejections, and bursts of plasma (solar cosmic rays, 90% protons & 9% Helium nuclei) streaming at 600 km/hour.

Svensmark (Henrick) - Henrik Svensmark (born 1958) is a Danish physicist and professor in the Division of Solar System Physics at the Danish National Space Institute (DTU Space) in Copenhagen. He is known for his work on the hypothesis that fewer cosmic rays are an indirect cause of global warming via cloud formation and cosmic rays seed cloud formation.

Talos Snow Pit – an ice dome located on the edge of the East Antarctic plateau, adjacent to the Victoria Land mountains. A major international project called TALDICE drilled a deep ice core here to study paleoclimate records, providing insight into Earth's climate history over hundreds of thousands of years.

Tholins – an orange/pink complex hydrocarbon and precursor to amino acids. Jupiter's Great Red Spot is comprised of tholins. Pluto and its binary planet Charon share a thin wispy atmosphere of tholins.

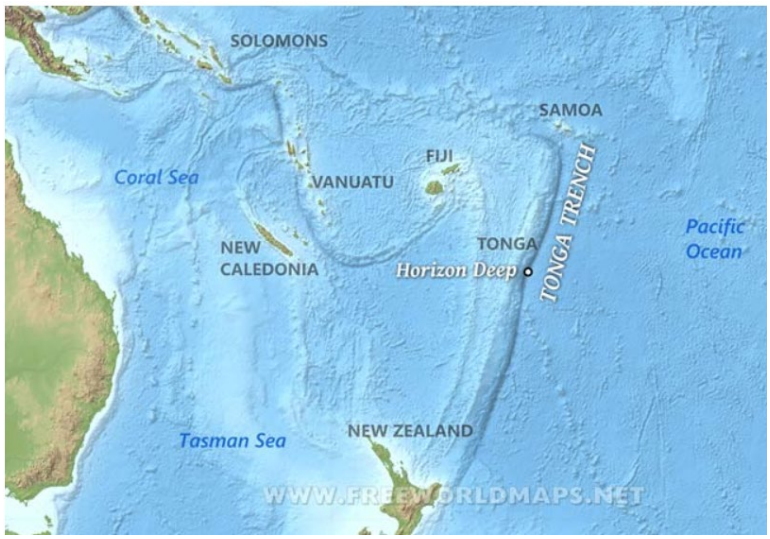
Tidal Pumping (Tidal Heating) – an Astrophysical phenomenon where the gravitational forces of major celestial bodies, like the Sun or the gas giants, "pump" or squeeze the solid crust of a smaller orbiting body, driving tectonic activity and other geological processes. This tidal force is not limited to oceans and it causes the Earth's crust to move and deform, potentially triggering earthquakes and contributing to volcanism. The phenomenon also applies to other celestial bodies, such as moons in eccentric orbits around gas giants, where tidal heating from gravitational forces can lead to volcanism and a "pumping" effect. Tidal Pumping of the Pacific plate coupled with Earth's counter-clockwise rotation has pushed and dragged Earth's continents into the Northern Hemisphere. Then God put Polaris in its position to help us find our way around. In the Southern Hemisphere, He gave us the Southern Cross.

Titan – a moon of Saturn with more hydrocarbons on its surface than all known oil reserves on Earth. Tidal Pumping (Tidal Heating) by Saturn causes bulges, or "solid tides," on Titan's surface that can be as high as 30 feet (10 meters). The varying force also causes Titan's shape to change from a rugby-ball shape when it is closest to Saturn to a more spherical shape at its farthest point. Evidence suggests that Titan has cryovolcanoes, which are volcanoes that erupt a mix of water and ammonia instead of molten rock.

Titus-Bode Law (Bode Law) – an empirical rule that provides a rough approximation for the relative distances of planets from the Sun. It successfully identified Ceres in the asteroid belt as well as Uranus. Neptune and Pluto deviate from the Bode Law. Robert J. Tuttle hypothesizes that the asteroid belt was originally a binary planet system he calls "Asteria", wherein the binaries spiraled down, collided, and broke apart or exploded.

Bode Law: Start with the series 0,3,6,12,24,48,96 …., where each number is double the previous one (except for the first two). Add 4 to each number in the sequence: 4,7,10,16,28,52,100 … divide each result by 10 to get to the approximate distances in astronomical units (AU).

Tonga Trench – the deepest oceanic trench in the Southern Hemisphere and the second deepest in the world, after the Mariana Trench and the fastest-moving trench in the world. Inside the Tonga Trench are the Tafu-Maka dual caldeira volcano that produced the largest explosion ever observed on Jan. 15, 2022, which raised the global humidity an estimated 5 to 10 %. The Tonga Trench is a major site of tectonic activity and is where the Pacific Plate is subducting beneath the Australian Plate.



Transition Zone – the region separating Earth's Upper Mantle from the Lower Mantle, extending from 410 to 660 km below Earth's surface. The upper portions of the Transition Zone are comprised of Wadsleyite, while the lower regions are comprised of Ringwoodite, a hydrous mineral. This Zone possesses an estimated 3x the amount of water as is in the oceans of the Earth, bound in these hydrous minerals. In the regions immediately below the Transition Zone, Ringwoodite dehydrates to release water and become Bridgemanite, which comprises 75-80% of the Lower Mantle.

Trap (Petroleum Trap) – underground geological formations that trap hydrocarbons, preventing their escape and allowing them to accumulate in a reservoir. These traps are essential for forming oil and gas deposits and are primarily categorized into two main types: structural and stratigraphic traps. Structural traps are formed by the deformation of rock layers, such as folding or faulting, while stratigraphic traps result from changes in rock layers, like the thinning or wedging out of a permeable layer. Volcanic lava domes (Siberian Traps) contain petroleum. Salt domes (West Texas Permian Basin) contain petroleum. Shales (Bakken formation) trap Kerogens.

Tuttle (Robert J.) – Author of "The Fourth Source. Effects of Natural Nuclear Reactors".

Tyndall (John) – (1820 – 1893). Glaciologist who dirtied his pants when he saw his beloved Alpine glaciers retreating in the 1850s. A total idiot. His crap was completely debunked by Knute Angstrom and Robert W. Wood.

Unzicker (Alexander) – a German theoretical physicist, science writer, and critic of contemporary theoretical physics and cosmology. He holds a degree in Law and a PhD in neuroscience. Unzicker is known for his popular science books. Author of "Make Physics Great Again (America has Failed)" and "Einstein's Lost Key".

Vixra.org – a "pre-print" publishing site based in Germany. I post my papers to Vixra.

Vostok, Antarctica – a location in East Antarctica known for its Russian research station and the subglacial Lake Vostok. Below the Vostok Station lies Lake Vostok, the largest of Antarctica's more than 400 known subglacial lakes. The freshwater lake is about the size of Lake Ontario and is buried beneath approximately 4 kilometers (2.5 miles) of ice. Ice cores from Vostok have identified Chlorine 36, an isotope produced from nuclear fission, evidence of the GeoReactor.

Wadsleyite – a high-pressure mineral found in the upper regions of the Lower Mantle. Deeper in, it converts to the hydrous mineral Ringwoodite which at a depth of 660 to 700 km down, converts to Bridgemanite and releases water. It is a polymorph of olivine, meaning it has the same chemical composition but a different crystal structure, and forms under the intense pressures found in Earth's mantle.

Yellowstone - The Yellowstone mantle plume originates deep within the Earth, with its current position under Yellowstone National Park, but its "track" or path of activity stretches across the United States. As the North American plate moved, the fixed hotspot's activity created a trail of volcanoes that began in the past, around 17 million years ago, near the Oregon-Idaho-Nevada border and progressed northeast towards the current location in Wyoming. The connection to New Mexico is less direct, but the immense scale of this "long-lived feature" and the tectonic history of the region that involves past volcanic activity and mountain building events in areas that are now New Mexico and Colorado can be considered part of the larger geological context. Seismic studies suggest the plume originates at the core-mantle boundary, potentially 2900 km deep.