

Glass Castles & Fire from the Sky

A New Theory of Ancient Vitrification

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Ancient Celtic traditions and Arthurian romances abound with tales of “glass castles” and “glass cities.” Ancient vitrified (that is, turned to glass) remains of stonework, buildings, and cities have been reported from around the globe.¹ Admittedly some of these reports are more reliable than others. Among the best-documented examples of ancient vitrification are various hill forts of the United Kingdom, particularly Scotland.²

Having studied ancient hill forts in Scotland and Wales, I can testify to the authenticity of vitrification. But what is its origin and significance? Drawing from decades of fieldwork that has taken me from Egypt to Easter Island, the answer I propose entails a new way of thinking about our ancient past.

Relatively few people are aware of vitrified stone forts, one of the great mysteries of antiquity. To the untrained eye, vitrified forts are not particularly impressive. They generally appear to be walls of stone rubble, lacking any true masonry work, built on the tops of hills. The majority of known vitrified forts are found in Scotland, with others reported from England, Ireland, Wales, and also France, Germany, and as far afield as Turkey and Iran. A typical example of a vitrified fort, one that I have examined firsthand, is the Mote of Mark in Scotland.

What distinguishes a vitrified fort? The stone walls and structures have been subject to intense heat, to the point where some of the rocks have melted and fused, forming masses of material that can resemble the slag produced when smelting and refining metals, similar to materials produced during some types of volcanic eruptions. It is referred to as “vitrification” (vitrum =

glass) because the melted rock can solidify as a crude, generally dark, glass which hundreds or thousands of years later may not look much like glass at all to the untrained eye. In order to melt and vitrify the rock, incredibly high temperatures are required – on the order of 1,000 degrees Centigrade. The vitrification typically occurs on the tops and outer surfaces of the rock walls, and not in their interiors. The big questions are how

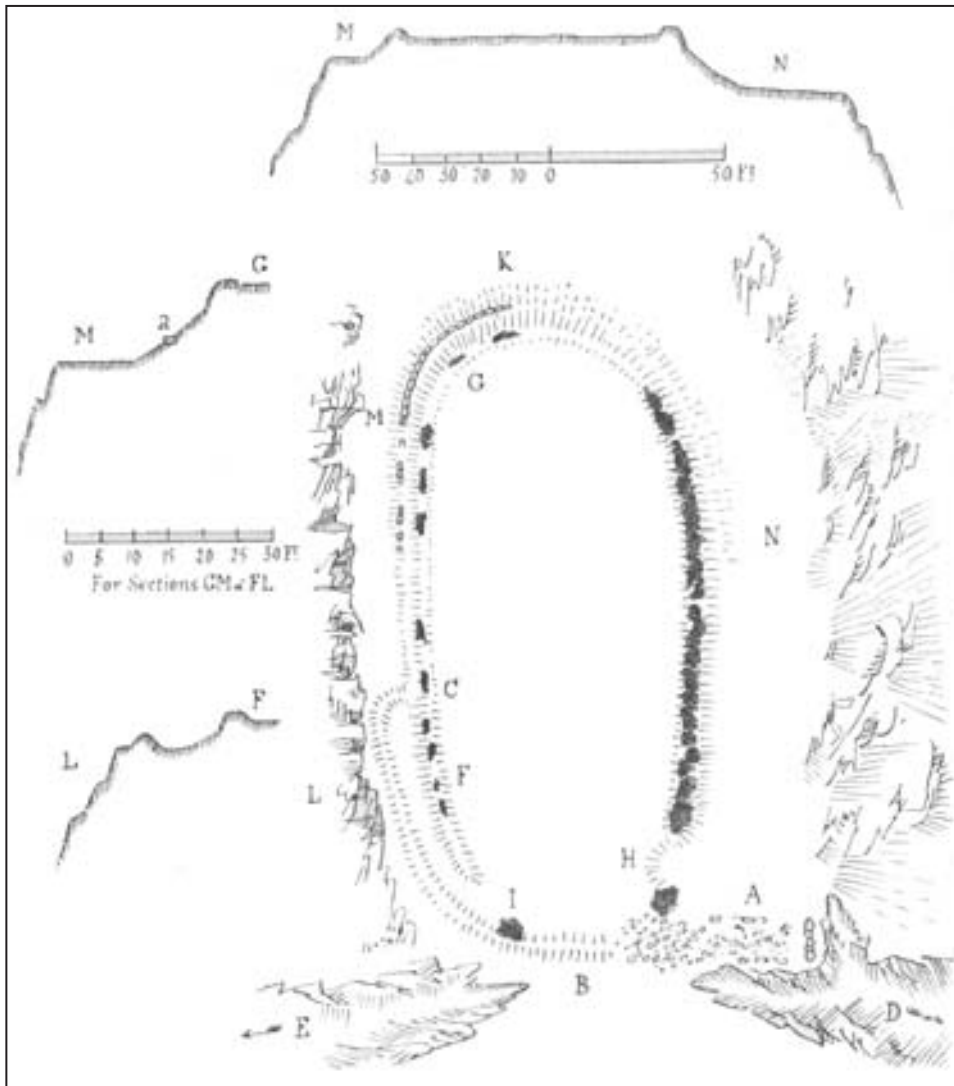
could this occur? And why? Before we address these questions, we need to consider another thorny issue: the timeframe of the vitrified forts, which in turn bears on the issue of how the forts may have been vitrified.

HOW FAR BACK DOES VITRIFICATION GO?

It is generally agreed among conventional historians and archaeologists that vitrified forts date back to at least the Iron Age (in the UK, about 800 BCE to the early centuries CE), and were used up through the early Dark Ages, circa 700 CE and later. The latter portion of this span, the late 5th and 6th

centuries CE, corresponds to the time when the famous King Arthur supposedly lived and died. King Arthur and the Knights of the Round Table may have gathered at a vitrified hill fort known as Camelot. A Welsh manuscript records a poem, titled PREIDDEU ANNWN (“The Spoils of Annwn” – Annwn refers to the “otherworld” or the world of the gods),³ attributed to the British bard Taliesin of the middle and late 6th century CE. The poem tells of Arthur and a Glass Fortress or Castle. Who would think of making a fort of glass? Traditionally the reference to glass has been seen as a fanciful metaphoric analogy to the realm of the gods and other beings. But, could it have been rooted in reality? Could genuine vitrified forts have been the basis for the concept of a glass fortress or castle? I believe the answer is yes.

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Plan of a typical ancient vitrified fort in Scotland with the vitrified areas indicated by the dark shading (Carradale Fort; from Early Fortifications in Scotland by David Christison, Edinburgh, 1898).

THE HOW AND WHY BEHIND VITRIFICATION

How did the Mote of Mark and other forts come to be vitrified? A number of explanations have been proposed.⁵ Some believe the builders of the forts did it purposefully, or alternatively that it was the result of attackers attempting to destroy the forts. If purposeful, perhaps vitrification was a way to bond and strengthen the rock walls in lieu of mortar. Huge amounts of wood and other flammable substances were presumably piled against the walls and set ablaze, creating intense heat and melting the surface rocks. The problem is that virtually all studies conclude that vitrified walls are actually weaker and more brittle than non-vitrified walls. The vitrification

However, this is not to say the vitrified forts necessarily originated at the time of the legendary chieftain. Vitrified forts may have been an inheritance from a much more remote period. Arthur and his contemporaries may have reused already very ancient forts, structures that had undergone vitrification centuries or millennia earlier. Indeed, the vitrified forts and other megalithic stonework might very well have been considered the “spoils of Annwn,” that is, the remnants of the world of the ancient gods. The Mote of Mark (the Scottish vitrified fort, also known as Rockcliffe) illustrates this possibility. During excavations, artefacts from the Roman and early Christian periods were found along with an abundance of material from the 6th and 7th centuries CE and even a piece of Mediterranean glass that could date to the 9th century CE. But, more remarkably, over a hundred worked flints possibly dating to the Mesolithic – that is, the period of circa 8000 BCE to 4000 BCE – were found.⁴ Thus, the Mote of Mark may trace its origins to 10,000 years ago, and was intermittently used and reused over the course of nine millennia!

occurs only on the upper surfaces and tops of walls, which are otherwise built on foundations of rubble, and thus could easily collapse.

Another popular theory suggests the vitrification resulted from enemy attacks. The forts were originally built of stone and wood, with wooden superstructures and in some cases wooden logs inside the stone and rubble walls. The assaulting enemy might have purposefully set the fort on fire, and the ensuing conflagration may have caused the vitrification. But could setting fire to a fort really generate the extremely intense heat necessary to melt rock? And why would the defenders continue to build structures containing so much wood that they were vulnerable to such attacks when there was certainly plenty of stone available?

Or, did the attackers possess a fire-based weapon that we no longer understand? Did they have something similar to modern napalm? Had they discovered a toxic mixture of flammable chemicals (the recipe a closely guarded secret that has since been lost) that could generate enormous temperatures and could not be extinguished? The classical ancients mention “Greek fire” that could be hurled and catapulted at the

enemy, and would even burn under water. But whatever “Greek fire” may have been, even if the accounts are not exaggerated, it is difficult to see how it could be used extensively enough to cause the amount and degree of vitrification seen in the forts.

Some researchers have suggested that vitrification along the tops of fort walls was the result of lighting beacon fires. But it is odd that beacon fires would be intense and hot enough to vitrify the rock. And those forts that are vitrified continuously around the perimeters, does that mean beacon fires were built in continuous lines along the tops of the walls? This too seems odd; it would perhaps make more sense to build beacon fires at designated spots best observed by those who were intended to see the fires. Or were the tops of the forts purposefully vitrified to make a sort of walking path?

At a loss to explain the reasons behind vitrification of the forts, one researcher suggested vitrification was a purposeful ceremonial or religious rite, despite the fact that the vitrification weakens the structure! Perhaps, according to this theory, vitrification was used to dedicate or “christen” a fort, or was an act of supplication to a deity, served to commemorate a victory or other significant event, or to simply inspire the masses. I cannot say that I find this theory particularly compelling.

More exotic theories have been proposed to explain the vitrification. One early idea suggested that the structures were built near ancient volcanoes, and the builders used naturally molten rock to construct their forts. In actuality the forts are not near active volcanoes, and how the builders would have transported and manipulated molten rock is a difficult question to answer. Another theory, popular to this day in some circles, is that the vitrification was the result of ancient atomic warfare. The vitrification occurs predominantly on the tops and outer edges of the walls, as if blasted by an incredibly intense heat from above. Furthermore, vitrified forts tend to be found on the tops of hills and other promontories. It certainly sounds like melted rock could have been produced by an atomic bomb exploding in the sky above, but did the ancients have nuclear weapons in the remote past?



FIRE FROM THE SKY

As appealing as ancient nuclear weapons may be to some sensibilities, I have my doubts and as a geologist I tend to look for other, more naturalistic, explanations first. However, the evidence does suggest that the causative factor originated from the skies above. A possible explanation, which I have heard more than a few times from various people over the years, is that perhaps the mid-air explosion of a meteor, comet, or asteroid, was responsible.⁶ Such an incoming space object (bolide) could create a tremendous blast in the atmosphere, generating intense heat and massive destruction over a widespread area, as was the case in Tunguska, Siberia, in 1908. The Tunguska object exploded with an estimated force of between 500 and 2,000 Hiroshima atomic bombs, scorching and levelling trees over a vast area, yet no major crater formed, perhaps because the explosion took place about 5 to 8 kilometres above Earth's surface. As I have documented in my book *Voyages of the Pyramid Builders*,⁷ Earth has had close encounters with comet-like objects a number of times in the last six thousand years, and certainly many times prior to recorded history. Indeed, there is good documentation

for a comet intersecting with Earth's orbit in the middle of the 6th century CE, the traditional period of King Arthur. Might a comet have been responsible, at least in part, for initiating the beginning of the Dark Ages, a time of calamity and loss? I find the comet explanation for the vitrified forts plausible, but there are other phenomena that originate in the sky as well. Even if it can be demonstrated that some vitrification dates to the sixth century and correlates with a cometary impact, it may be an incorrect oversimplification to conclude that all episodes of vitrification were due to close encounters with comets.

Major lightning strikes can cause intense heat discharges resulting in the melting, fusing, and vitrification of sand and rock.⁸ But is simple lightning, as we know it today, intense enough and extensive enough to explain the amount and degree of vitrification observed on the ancient forts? I believe something more is needed.

Lightning is actually a type of plasma phenomenon. Plasmas essentially consist of ionized gases or charged particles, and together with magnetic and electric fields, they ubiquitously pervade interplanetary to intergalactic space. The aurorae borealis and australis (northern and southern lights) are plasma related phenomena, as are large-scale upper atmospheric phenomena known as sprites. There is evidence that in the ancient past the surface of our planet was occasionally subjected to major plasma events. These may have taken the form of huge electrical outbursts with electric "sparks" or "lightning" that hit the surface, incinerating any flammable materials and melting and vitrifying the underlying rocks. The cause may have been plasma outbursts from our own Sun, or the close flyby of an electrically charged space object. We just do not know; but the forts sitting at high elevations could have served as lightning rods, attracting intense electrical currents that resulted in their vitrification.

ANCIENT PLASMA EVENTS

In 1962 astrophysicist Thomas Gold (1920-2004) speculated on the possibility of intense plasma outbursts affecting the surface of Earth.⁹ Four decades later plasma physicist Anthony L. Peratt followed up on Gold's suggestion, finding evidence of powerful ancient plasma phenomena in the form of petroglyphs – records engraved by the ancients on rocks of the figures and patterns they apparently observed in the skies.¹⁰ Building on the work of Gold and Peratt, I suggested that the enigmatic Easter Island rongorongo texts record plasma phenomena millennia ago, and in fact there may have been a major plasma event that struck Earth in circa

9700 BCE which initiated the final melting that brought the last ice age to an end.¹¹ A series of strong plasma events may have wreaked havoc on Earth during the millennia immediately following the end of the last ice age. The incredibly sophisticated, and incredibly early, site of Göbekli Tepe in southeastern Turkey dates to around 10,000 to 9000 BCE and was intentionally buried by 8000 BCE.¹² Was it buried in response to, perhaps as a way to try to protect it from, a major plasma event?

If major plasma phenomena impacted Earth in ancient times, where did the plasma come from? Although plasma events could conceivably be generated by a number of different types of astronomical phenomena, perhaps a close flyby of a comet or other object, or by plasma or cosmic ray particles originating from outside of our solar system, Gold and Peratt look to our Sun. Indeed even in historical times the Sun has shown major instabilities, known as solar storms, and has occasion-

ally thrown off chunks of plasma, referred to as coronal mass ejections. The most severe occurrence in modern times is the 1859 Carrington Event when, over several days in late August and early September, intense solar flares and magnetic storms took place and two coronal mass ejections released by the Sun collided with Earth.¹³ The Carrington Event was certainly not an isolated phenomenon, and probably not particularly large by astrophysical standards; I firmly believe similar but more powerful and destructive events happened in the past, and will happen again in the future.¹⁴

Solar activity over the last 11,450 years has been reconstructed in various manners, particularly using ¹⁰Be and ¹⁴C data from ice cores.¹⁵ Among other factors, solar activity can be gauged based on sunspot numbers (higher numbers of sunspots correlate with higher solar activity) which in turn can be reconstructed for the past using the isotope data (primarily ¹⁴C and ¹⁰Be). Such studies show a number of minima and maxima in solar activity. Maxima occur, for instance (looking at the two millennia just after the end of the last ice age) at circa 9375 BCE (as far back as the data goes in the particular study), 8915 BCE, 8350 BCE, 8030 BCE, 7850 BCE, 7780 BCE, and 7660 BCE while minima occur at

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(Right top) Ancient burnt and vitrified rocks found in the walls of the Mote of Mark.

*(Right bottom) Example of vitrified rock found in the walls of the Mote of Mark; scale is in centimetres.
(Photos courtesy of R. Schoch)*





Altitude, km

100

80

60

40

20

First Color Image of a Sprite
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(Left top) *Lightning – a type of plasma phenomenon – strikes over an ancient fort. Major lightning strikes can cause intense heat discharges resulting in the melting, fusing, and vitrification of sand and rock.*

(Left bottom) *Colour image taken from an aircraft of a modern upper atmospheric electrical discharge and plasma configuration known as a "sprite" which is suggestive of the powerful plasma configurations seen in the ancient skies from the ground. (Public Domain Image; University of Alaska, Fairbanks.)*

9165 BCE, 8215 BCE, and 7515 BCE.¹⁶ However, it is important to realise that a major plasma phenomenon, such as a coronal mass ejection from the Sun, may not correlate with overall background solar activity. The 1859 Carrington Event occurred between the last solar minimum of circa 1680 and the current solar maximum, which dates to about 1960 and is ongoing. As plasma physicist Paul Kintner (Cornell University) commented, "The Carrington event happened during a mediocre, ho-hum solar cycle... It came out of nowhere, so we just don't know when something like that is going to happen again."¹⁷

Whereas even a large plasma event in the distant past might not be readily detected in the ¹⁴C and ¹⁰Be records, there is the possibility that it could be picked up as a distinct nitrate spike. According to current theory, energetic particles associated with solar outbursts and coronal mass ejections increase atmospheric nitrate production, subsequently captured in ice cores. Ice cores dating back to 1561 show a series of nitrate events that correlate with solar events; the 1859 Carrington event corresponds to the largest spike in the series.¹⁸ In the deeper geological record, nitrate spikes also occur, including major nitrate spikes during and after the end of the last ice age, including nitrate spikes that seem to bracket the Younger Dryas cold spell (circa 10,900 to 9700 BCE) that preceded the final end of the last ice age, and another major nitrate spike that may date to the middle or late 9th millennium BCE.¹⁹ Nitrate spikes do not unambiguously indicate major plasma events, however; nitrate spikes are also associated with comets and other bolides. The Younger Dryas may have been initiated by a comet impact or explosion in the atmosphere, producing an increase in nitrates, and brought to an end by a large plasma event that also produced nitrates. To distinguish bolide-associated nitrates from plasma-associated nitrates, one may have to look to other markers, perhaps such as an iridium spike, which would be more readily associated with bolides than plasma.

Based on the data we currently have, I believe that both bolide impacts/explosions and major plasma events have influenced human prehistory and history. Returning to the theme of vitrified forts, could at least some of the vitrification be due to plasma events? I believe so – and that some of the forts date as far back as 10,000 years ago or more, just after the end of the last ice age, a time when I believe a major plasma event (or events) occurred on Earth, as probably evidenced by the nitrate data as well as the petroglyphs, rongorongo records, and the intentional burial of Göbekli Tepe.

PLASMA IMPACTS

Certain common themes of antiquity may reflect the historical impacts of plasma phenomena. Let us look at a few examples.

Flood stories are found around the globe. The story of Noah and the ark has many versions in different

cultures (for instance, the deluge experienced by the Sumerian king Gilgamesh). *Genesis* tells of forty days and forty nights of rain, or in other words it rained continuously for an incredibly long period of time.

What might have caused this? A major plasma event could vaporise large amounts of water from lakes and oceans, which in turn would rain down continuously and cause widespread flooding. My research has determined that the Great Sphinx in Egypt dates back minimally to circa 5000 BCE, and quite possibly back to 9000 BCE or earlier, and was subject to intense rains.²⁰ Could these be rains

that followed plasma bombardments?

Major plasma phenomena could not only cause vitrification, but if sufficiently intense could literally incinerate the surface of Earth, including human structures and artefacts. Only massive stone structures, or materials that were buried, hidden in caves, or otherwise protected from the aerial bombardment would have a chance of surviving. Is this why the ancients often built megalithic stone structures (even after the plasma was gone, remembering what had happened in the past)? Do some of these stone structures actually belong to another time – to the "world of the gods"? Is this why in some regions dwellings were not so much built, but rather carved into cliffs or deep underground in bedrock? The extensive rock cut temples and dwellings of Cappadocia (Turkey), the solid stone buildings of Petra (Jordan), the rock cut churches of Lalibela (Ethiopia), and the cliff dwellings of the Anasazi (western United States) come to mind. Is some of this the handiwork of a more advanced people facing potential annihilation? Furthermore, a plasma event would significantly decrease the ozone layer for years, or longer, subjecting all

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life to harmful ultraviolet light. One strategy to try to protect oneself would be to stay underground as much as possible. Perhaps this theory explains why we see no significant human/civilised activity for thousands of years – until it kick starts again in Egypt and elsewhere.

Plasma discharges are electrical in nature. We do not know the full effects and ramifications of subjecting living organisms, including humans, to intense electrical fields. Those who survived might be altered genetically, mentally, and psychically. Laboratory studies demonstrate that plant seeds and fish eggs, subjected to strong electrical fields, can be altered genetically, giving rise to either previously unknown varieties of organisms or apparently ancestral organisms that were believed to have gone extinct. In one experiment trout eggs gave rise to a giant trout.²¹ Mental functioning and psychic ability are affected by electromagnetic fields.²² Could occasional periods of intense plasma phenomena on Earth act to alternatively accelerate, or decelerate, organismal change, both physical and mental? Might powerful plasma phenomena act as a switching mechanism, causing biological and mental changes? Many cultures have a tradition of cyclical change, such as the Gold, Silver, Bronze, and Iron Age; the Yuga Cycle; or the Precessional Cycle of the World Ages (we are currently transitioning from the Age of Pisces to the Age of Aquarius). Might plasma phenomena be involved in transitions from one age to another?

We live in a plasma universe. A National Research Council report states, “Plasma is... ubiquitous in the universe. Plasmas pervade intergalactic space, interstellar space, interplanetary space, and the space environments of planets.”²³ It is foolish to ignore the possibility that major plasma events have influenced our past – for they clearly have. And we can be certain the plasma will hit again.

FOOTNOTES

1. For general information on vitrification, see: Anonymous, “Vitrification of Hill Forts: Gazetteer [sic] and Research Guide”, posted at www.brigantesnation.com/VitrifiedForts/VitrifiedForts.htm (Accessed 7 July 2010); Jeremy Condick, “The Vitrified Forts of Scotland”, article posted at www.logos_endless_summer.tripod.com/id139.html (Accessed 20 April 2009). Here I am using the term “vitrification” in the sense of rock melted and turned to glassy substances; I am not including the more general concept of supposedly “softened” and “molded” rock as, for instance, discussed by Jan Peter de Jong, “Ancient mysteries: vitrified and moulded rocks,” posted at www.ancient-mysteries-explained.com/vitrified-rocks.html (Accessed 5 July 2010).

2. David Christison, *Early Fortifications in Scotland: Motes, Camps, and Forts*, Edinburgh: William Blackwood and Sons, 1898; see Chapter 4, “Vitrified Forts”, 169-196.

3. Sarah Higley, Text and Translation, “PREIDDEU ANNWN: ‘The Spoils of Annwn’”, article posted at www.lib.rochester.edu/camelot/annwn.htm (Accessed 25 April 2010). For general comments on vitrified forts and glass castles of the Arthurian romances, see: Roland Comte, “The Mystery of Vitrified Hillforts”, article posted at www.brigantesnation.com/VitrifiedForts/TheMysteryofVitrifiedHillforts.htm (Accessed 30 June 2010); Charles Squire, *Celtic Myth and Legend*, Chapter 21, “The Mythological ‘Coming of Arthur’”, 1905, posted at www.sacred-texts.com/neu/celt/cml/cml25.htm (Accessed 7 July 2010).

4. Royal Commission on the Ancient and Historical Monuments of Scotland, “Mote of Mark: Archaeological Notes”, posted at www.canmore.rcahms.gov.uk/en/site/64911/details/mote+of+mark/ (Accessed 5 July 2010).

5. The theories in this section are compiled from both discussions I have had at various conferences and meetings, and from references cited in notes 1. and 2. [above] and sources cited therein.

6. See for instance the discussion comments that mention meteor/asteroid/comet explanations for vitrification dated 30 November 2005 on the forum posted at www.unexplained-mysteries.com/forum/lofiversion/index.php/t48335-50.html (Accessed 5 May 2009).

7. Robert M. Schoch with Robert Aquinas McNally, *Voyages of the Pyramid Builders: The True Origins of the Pyramids from Lost Egypt to Ancient America*, New York: Jeremy P. Tarcher/Penguin, 2003. I also discuss the 1908 Tunguska event in *Voyages*.

8. Lightning that strikes silica/quartz sand (or similar substances) can cause the sand to melt, fusing the sand grains together to form natural glass tubes and other structures, known as fulgurites.

9. Thomas Gold, “Large Solar Outbursts in the Past”, *Semaine D’Etude sur Le Probleme du Rayonnement Cosmique dans L’Espace Interplanetaire*, Conference at the Vatican Academy of Sciences, October 1962, *Pontificiae Academiae Scientiarum Scripta Varia*, vol. 25, 159-166, [discussion of Gold’s paper, 167-174], (1963).

10. Anthony L. Peratt, “Characteristics for the Occurrence of a High-Current, Z-Pinch Aurora as Recorded in Antiquity”, *Institute of Electrical and Electronics Engineers Transactions on Plasma Science*, vol. 31, no. 6, 1192-1214 (December 2003); Anthony L. Peratt, John McGovern, Alfred H. Qöyawayma, Marinus Anthony Van der Sluijs, and Mathias G. Peratt, “Characteristics for the Occurrence of a High-Current, Z-Pinch Aurora as Recorded in Antiquity Part II: Directionality and Source”, *Institute of Electrical and Electronics Engineers Transactions on Plasma Science*, vol. 35, no. 4, 778-807 (August 2007); A. L. Peratt and W. F. Yao, “Evidence for an Intense Solar Outburst in Prehistory”, *Physica Scripta* (The Royal Swedish Academy of Sciences), 13 pages (December 2008).

11. Robert M. Schoch, “An Ancient Warning, A Global Message, From the End of the Last Ice Age”, *New Dawn* 121, 15-22 (July-August 2010). The idea that the rongorongo script records ancient plasma phenomena received its inspiration when my wife, Catherine Ulisse, first noticed the similarities between the rongorongo characters, petroglyphs, and the plasma configurations simulated and modelled by Anthony Peratt.

12. Robert M. Schoch, [Article on Göbekli Tepe], in press, *New Dawn* 122, September-October 2010. See also: Klaus Schmidt, *Sie bauten die ersten Tempel: Das rätselhafte Heiligtum der Steinzeitjäger, Die archäologische Entdeckung am Göbekli Tepe*, München: Deutscher Taschenbuch Verlag, 2006/2008; Graham Chandler (photographs by Ergun Çağatay), “The Beginning of the End for Hunter-Gatherers”, *Saudi ARAMCO World*, vol. 60, no. 2, 2-9 (March/April 2009); Andrew Curry (photographs by Berthold Steinhilber), “The World’s First Temple? Predating Stonehenge by 6,000 years, Turkey’s Stunning Gobekli Tepe Upends the Conventional View of the Rise of Civilization”, *Smithsonian*, vol. 39, no. 8, 54-58, 60 (November 2008); Patrick Symmes, “History in the Remaking: A temple complex in Turkey that predates even the pyramids is rewriting the story of human evolution”, *Newsweek*, 1 March 2010, article published online 19 February 2010 at www.newsweek.com/id/233844 (Accessed 29 April 2010).

13. National Research Council of the National Academies (United States), Committee on the Societal and Economic Impacts of Severe Space Weather Events: A Workshop, *Severe Space Weather Events – Understanding Societal and Economic Impacts, A Workshop Report*, Washington, D.C.: The National Academies Press, 2008; for a good overview of the Carrington Event, with references to other works, see Chapter 1, “Introduction”, 6-15. The article by Sten F. Odenwald and James L. Green, “Bracing the Satellite Infrastructure for a Solar Superstorm”, originally published in *Scientific American* (August 2008) and posted at www.spec-tregroup.wordpress.com/2010/05/12/a-carrington-event/ (Accessed 3 July 2010), contains a good summary of the Carrington Event.

14. There are critics of this theory, however. C. Leroy Ellenberger has argued against the concept of powerful plasma phenomena affecting Earth during the last 12,000 years (three emails from Ellenberger to R. Schoch, dated 13 June 2010, which include correspondence from Ellenberger to A. L. Peratt and others dated 15-16 March 2008). Ellenberger assumes that such a plasma event would last a century or more,

and would therefore interfere with the production of ^{10}Be and ^{14}C in the atmosphere, meaning that these isotopes should show a perceptible decrease in ice cores and other stratigraphic sequences whenever such major plasma events occurred. Ellenberger cites a study [note 15., below] that, according to Ellenberger, failed to record significant drops in ^{10}Be and ^{14}C during the last 12,000 years. He therefore concludes that major plasma events, as suggested by Peratt and his colleagues, did not occur. However, I believe Ellenberger has made incorrect assumptions and misinterpreted the data.

Ellenberger assumes that a powerful plasma event would last a century or more, and therefore have a significant effect on the production of ^{10}Be and ^{14}C . In my hypothesis, a major plasma event might only last on the order of days to months. The Carrington Event of 1859 lasted only a few days, and would probably not be picked up in the type of records of isotope production Ellenberger cites (the paper he cites does not include pertinent details for the nineteenth century). In my assessment, even a plasma event orders of magnitude larger than the Carrington Event, if it was of very short temporal duration, may not be easily resolved (if at all) in the isotope records that we currently have; isotope production would be high before and after the event, and the lack of production for a few days in a record from thousands of years ago would be very difficult to impossible to detect. Finding such a short-term dip in the isotopes is much more difficult than finding a spike, such as the iridium and associated spikes that can be indicative of major meteor, comet, and asteroid impacts.

Furthermore, the study Ellenberger cites [15., below] does not appear to me to support his assertions. The study goes back slightly over 9,000 years for ^{10}Be and it goes back 11,450 years for ^{14}C , and it shows spikes in solar activity at about 9400 BCE, 8900 BCE, 8300 BCE, and 8000 BCE (as well as spikes since then; see Figure 6 in the paper cited in note 15.), all well above current solar activity.

For background on Ellenberger, a former advocate turned critic of Immanuel Velikovsky's catastrophist scenarios, see http://en.wikipedia.org/wiki/C._Leroy_Ellenberger (Accessed 7 July 2010). For some publicly posted comments by Ellenberger criticising the work of Peratt and others, similar to those sent in his emails to R. Schoch, see www.mikamar.biz/sc-sk/scientism-2.htm (Accessed 7 July 2010).

15. Maura Vonmoos, Jürg Beer, and Raimund Muscheler, "Large variations in Holocene solar activity: Constraints from ^{10}Be in the Greenland Ice Core Project ice core", *Journal of Geophysical Research*, vol. 111, A10105, 14pp. (2006); available from www.agu.org/pubs/crossref/2006/2005JA011500.shtml (Accessed 7 July 2010). This paper discusses both ^{10}Be and ^{14}C data.

16. I. G. Usoskin, S. K. Solanki, and G. A. Kovaltsov, "Grand minima and maxima of solar activity: new observational constraints," *Astronomy and Astrophysics*, 471, 301-309 (2007).

17. Quoted in Michael Brooks, "Space storm alert: 90 seconds from catastrophe", article originally published in *New Scientist*, 23 March 2009; available from www.world-mysteries.com/sci_spaceweather1.htm (Accessed 2 July 2010).

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Identification in polar ice, 1561-1950", *Journal of Geophysical Research*, vol. 106, no. A10, 21,585-21,598 (1 October 2001); see also, K. G. McCracken, G. A. M. Dreschhoff, D. F. Smart, and M. A. Shea, "Solar cosmic ray events for the period 1561-1994. 2. The Gleissberg periodicity", *Journal of Geophysical Research*, vol. 106, no. A10, 21,599-21,609 (1 October 2001).

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