Geophysical Implications of \textit{tresino} formation: a narrative review

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November 23, 2022

Abstract

Recent understandings regarding \textit{tresinos} in laboratory experiments and geophysical observations represents a new paradigm for Earth's energy generation as well as a new direction toward developing \textit{tresino}-generated power reactors.

BIOGRAPHIES

Frederick J. Mayer [Ph.D. Physics, Case Western Reserve University 1968] is currently president of Mayer Applied Research, Inc., where he provides research and consulting in plasma physics, laser and magnetic fusion, and materials science. He was a senior research associate at Case Western Reserve 1968-1971 and director of advanced research and primary scientist at KMS Fusion, Inc. 1971-1988. Dr. Mayer is a fellow of the American Physical Society, a holder of several laser-related patents, and author of more than 60 peer-reviewed technical papers.

Selected publications:

- F. J. Mayer and John R. Reitz, "A parametric heat flow model in the spherical earth," Solid Earth Sciences (2019), in press.
- F. J. Mayer, "Superconductivity and Low-Energy Nuclear Reactions," Results in Physics 12 (2019) 2075-2077
- F. J. Mayer, "The Baryon Phase-Transition Model and the *too strange* Standard Model of Cosmology," *Universe* 2017, 3, 18; doi:10.3390.
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- F. J. Mayer and J. R. Reitz, "Thermal Energy Generation in the Earth," Non. Processes in Geophysics 21, 1-12, (2014).
- F. J. Mayer and J. R. Reitz, "Electromagnetic Composites at the Compton Scale," Int. Journ. of Theoretical Physics 51, 322-330, (2012).

John R. Reitz [Ph.D., University of Chicago, 1949, under Edward Teller] was a member of the Theoretical Division of Los Alamos Scientific Laboratory from 1949 to 1954, and a consultant to the Lab until 1964. He was a faculty member of Case Institute of Technology (now Case Western Reserve University) from 1954 to 1965 and was appointed Professor of Physics in 1960. From 1965 to 1987 he was manager of the physics department at Ford Motor Company. A fellow of the American Physical Society, Dr. Reitz has written approximately 50 scientific papers in the fields of solid state physics, magneto-hydrodynamics, energy conversion, and applications of electromagnetic theory. His textbook, *Foundations of Electromagnetic Theory*, is a standard in many physics departments. Dr. Reitz passed away in June 2014.

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2019

Geophysical Implications of *tresino* formation: a narrative review

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Key Points:

- A new paradigm for Earth's energy generation is presented.
- A new interpretation of magnetotelluric imaging is reviewed.
- A new proposal for *tresino*-power reactors is presented.

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Abstract

Recent understandings regarding *tresinos* in laboratory experiments and geophysical observations represents a new paradigm for Earth's energy generation as well as a new direction toward developing *tresino*-generated power reactors.

1 Introduction and History

This paper reviews the physics and geophysics results of my late colleague, John Reitz, and me over the past number of years; it is presented in the form of a physics *narrative*, in part because all our work has been previously published. The *narrative* form avoids duplication but importantly shows how the various results of our work over these years are interconnected; the mathematical details and physics/geophysics arguments may be found in our referenced publications. I hope this presentation will make the importance of our work easily understood, retrieved, and useful.

Our efforts started with the research into the area initially called *cold fusion* and later referred to as *low-energy nuclear reactions.* Having had substantial experience in nuclear physics these experiments clearly presented a challenge to contemporary physics as we explained in our IJTP paper [Mayer & Reitz (2012)]. Therefore, we decided to examine possible alternative particle composites that may have been overlooked in the early days of the development of nuclear and atomic physics in the last century. After considerable efforts along these lines, including numerous false starts, we finally came to focus on a new conceptual configuration - an apparently *strange* Compton-scale composite, specifically the *tresino* (shown schematically in Figure 1) that might be responsible for the experimental observations. Indeed, observations in other areas of physics were also suggested in this early paper and have been discussed in other publications.

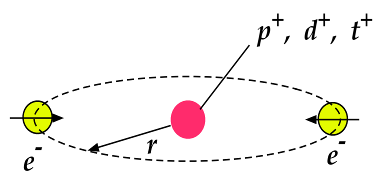

Figure 1. The *tresino* composite - it's a *bound-state* held together in a balance of electrostatic and electron-dipole magnetic forces.

To many readers, the *tresino* may appear strange because it has a net-negative charge; how a proton acquires its two electrons in the *tresino* is both interesting and complicated as I discuss in Sections 4 and 5. Importantly, the *tresino* is a bound-state (at ≈ 3.7 keV) so when it's formed it must release its binding-energy; furthermore it will persist unless the binding-energy is somehow resupplied. Note that a second proton neutralizes the proton *tresino* at atomic mass two.

Although our basic picture from this IJTP paper did have implications for the *cold fusion* issue (see Section 4), we considered that the somewhat less controversial research involving the energy released from the Earth might be a better early application of *tresino*-formation physics; so we proceeded with our research in the geophysics arena. (Note: the nominal depth at which the energy generation in the Earth obtains is discussed in Section 6.)

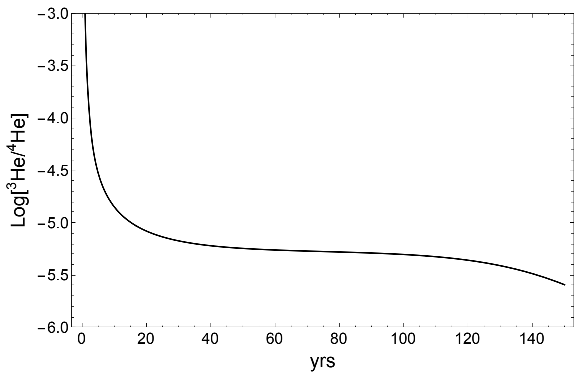

Figure 2. The ratio of ^{3}He and ^{4}He as a function of time from the numerical solution of the reaction rate equations.

2 *Tresinos* and Energy Release from the Earth

We had been aware that there were numerous problems for decades within the existing geophysics data and we discussed these we in our paper [Mayer & Reitz (2014)]. After reviewing these issues, we developed the *tresino*-based physics that we then showed could resolve many of these problems. In particular, we showed how this physics correctly gave rise to the ratios of ^{3}He and ^{4}He over decades after their generation from the formation of: i) *proton tresinos*, and ii) the later-arising *deuteron-tresino* nuclear reaction chain. The integration of the reaction rate equations resulted in plots of the various species as functions of time. The*deuteron-tresino* nuclear reaction chain gave rise to the origin of ^{3}He, to energy generation, and furthermore, the ratio of ^{3}He and ^{4}He. Figure 2 shows this ratio. As our paper showed, this ratio agrees well with the observed geophysics data that observed this ratio is orders of magnitude higher early in time (or closer to the reaction zone) and is $\approx 10^{-5}$ decades later (or much farther from the reaction zone). Perhaps more interesting, due to the energetic ^{4}He from the end of the deuteron nuclear reaction chain some secondary nuclear reactions were found for the otherwise difficult to explain but experimentally observed excess nuclides such as ^{10}Ne and ^{40}A.

Although this paper did show how *tresinos* could generate the low-energy nuclear reactions, at that time we did not understand the physics of how the *tresinos* acquired their electron pairs; I discuss this physics in Sections 4 and 5.

3 Magnetotellurics

Here the discussion begins with my attempts to more fully understand the physics of magnetotelluric (MT) images. Let's examine one such example presented in Figure 3. I started by examining Chapter 3 by Professor Rob L. Evans in [The Magnetotelluric Method: Theory and Practice]. It seemed clear to me that there was considerable uncertainty regarding the physical mechanisms that produce certain highly-conductive regions around the Earth. As this was the case, I had suggested [Mayer, (2018)] that the mechanism overlooked in the theory of the magnetotelluric surveys is that of *superconductivity* in certain Earth-based materials at special locations. In his discussion of the mechanisms, Evans has a section (page 76) on carbon as an often-invoked source of the high-conductivity zones but he finds it to be generally not too compelling, hence inconclusive. I point out that Professor Evans did not consider that, in some laboratory experiments in recent years, have found some carbon compositions display a marked superconductivity [Yankowitz, et. al.,(2019)]. Although this latter paper is suggestive, a more directly relevant series of recent experiments [T. Scheike, et. al., (2012)] has shown

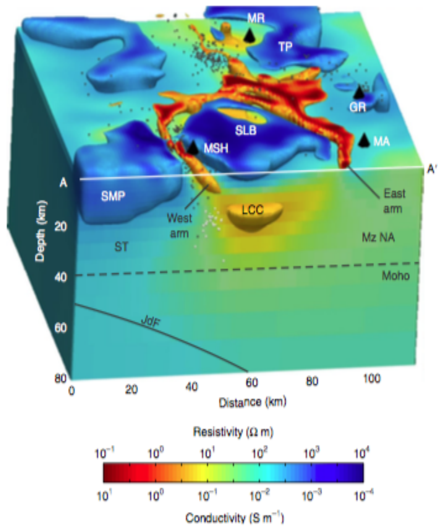

Figure 3. An MT scan showing the response under a volcanically active region. It displays quite different levels of electrical conductivity even in fairly closely connected regions; this figure was reproduced from reference [Bedrosian, et. al., (2018)]

superconductivity in processed granular carbon (powder) processed with added water and heating to produce superconductivity at elevated temperatures. This suggests a specific mechanism that would be accessible to much of the available carbon, in some form, found in the relatively near-surface geologic formations in the Earth. Of course some other materials might produce this effect but the Scheike, et. al., experiments appear to be a basis for further examination for understanding both the high-conductivity MT images. Furthermore they may also be required for the thermal energy generation in the earth [Mayer & Reitz (2014)] by delivering electron pairs in *tresino*-formation.

4 Superconductivity and *cold fusion*

Recently, I had become aware [Mayer, (2019)] of an earlier published paper regarding an experiment in *cold fusion* that revealed high-loading of *hydronium ions* (H_3O^+) into a palladium cathode induced a superconducting phase transition in the electron fluid, *i.e.*, that created Cooper pairs, along with some energy release from the formation of *tresinos*. Figure 4, copied from this paper, shows how the Cooper pairs combines with the hydronium ion to generate the energy release in *tresino* formation. This was an important observation that showed how superconductivity (Cooper pairs) in laboratory experiments had allowed the generation of energy from the formation of *tresinos*, hence this answered the question "how did *tresinos* acquire their electron pairs?". Perhaps most Important, this physics was required to release the *tresino*-formation energy.

5 Superconductivity and energy generation in geophysics

Even though *tresino* generation in *cold fusion* appears in a laboratory situation because Cooper pairs are being formed at high-loading of hydronium ions in palladium cathodes, there would be no such generation in the Earth. So what could be happening in the latter situation? The answer can be found by noting the above mentioned observations regarding magnetotellurics and examining my recent papers [(Mayer (2018) and Mayer (2019)]. In geophysics some regions are found that have a ready supply of Cooper pairs. This might be expected because carbon is the 15th most abundant element in the Earth's

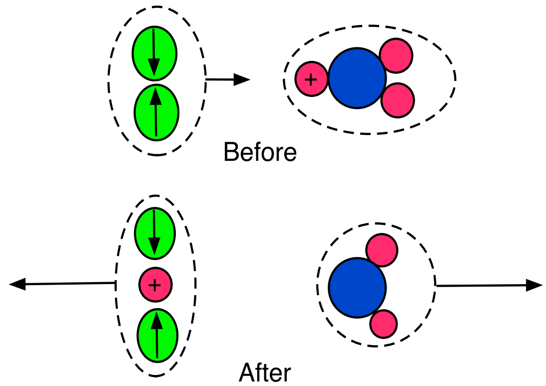

Figure 4. The *tresino*-formation collision of a Cooper pair and a hydronium (H_3O^+) ion.

crust and in some places it is not combined with other elements in minerals. As has been shown in [Yankowitz, et. al.,(2019) and T. Scheike, et.al.,(2012)] carbon, probably in the form of graphite powder, is present to provide for the Cooper pairs resulting in the magnetotelluric images and with sufficient water (*i.e.*, hydronium ions) present to create the formation of *tresino*-formation energy release. So, in the geophysics situation, the combined availability of carbon (with its Cooper pairs) along with the presence of enough hydronium ions (enough water) the release of energy then starts the *tresino*-formation energy transition. Although isolated carbon deposits may be likely, carbon in carbonatites see [wikipedia,(Carbonatite)]with multiple carbon surfaces or interfaces, represent another possibility.

6 Heat-Flow from the Earth

In our early work on the energy generation in the Earth [Mayer & Reitz (2014)], we gave an estimate of where the energy was being generated at a relatively shallow depth. In a more recent paper [Mayer & Reitz (2019)] we present a better model calculation showing that the energy is being generated in a thin layer at about 35 km below the surface. This depth is shallow enough for there to be sufficient water having been either leaked-in or entrained and for there to be sufficient carbon available as well. Furthermore, this work suggests that no deep-interior source is required for energy generation, an often suggested idea in geophysics.

7 Toward *tresino* Reactors

It should be clear that access to *tresino*-formation generating power might be achieved by constructing the configurations similar to those described above in the geophysical arena; namely a source of hydronium ions (water) and a source of superconducting material such as processed carbon powder as in [Scheike, et al.,(2012)] possibly processed at somewhat elevated temperature and pressure. If this picture is correct, experiments along these lines should reveal operating conditions for *tresino*-generated power reactors.

Finally, in this narrative, I have suggested how the geophysics of energy generation can be a guide to develop *tresino* reactors here on the surface not just at 35km below the surface. Of course, it will require substantial experimental efforts for this to be realized.

Acknowledgments

Data Available Statement: No new data was used in this paper. The data on which this article is based are all available in [Mayer&Reitz,(2012)], [Mayer&Reitz,(2014)], [The Magnetotelluric Method: Theory and Practice,(2012)], [Mayer,(2018)], [Yankowitz, et.al.,(2019)], [Scheike,T.,et.al.,(2012)], [Bedrosian, et.al., (2018]], [Mayer,(2019)], and [Mayer&Reitz,(2019)].

With deep gratitude, I acknowledge my late colleague, mentor, and friend, Dr. John R. Reitz, without whom this work would never have become possible.

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This image was reproduced from Bedrosian, P. A., Peacock J. R., Bowles-Martinez, E., Schultz, A., and Hill, G. J., *Nature Geoscience*, **11**, (2018), 865870, https://doi.org/10.1038/s41561-018-0217-2.

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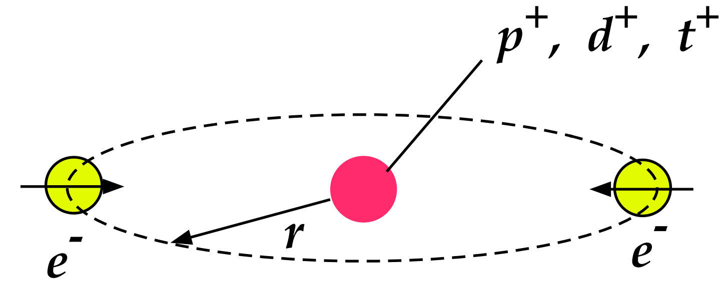
Figure 1.



p+, d+, t+
r
e-
e-

Figure 2.

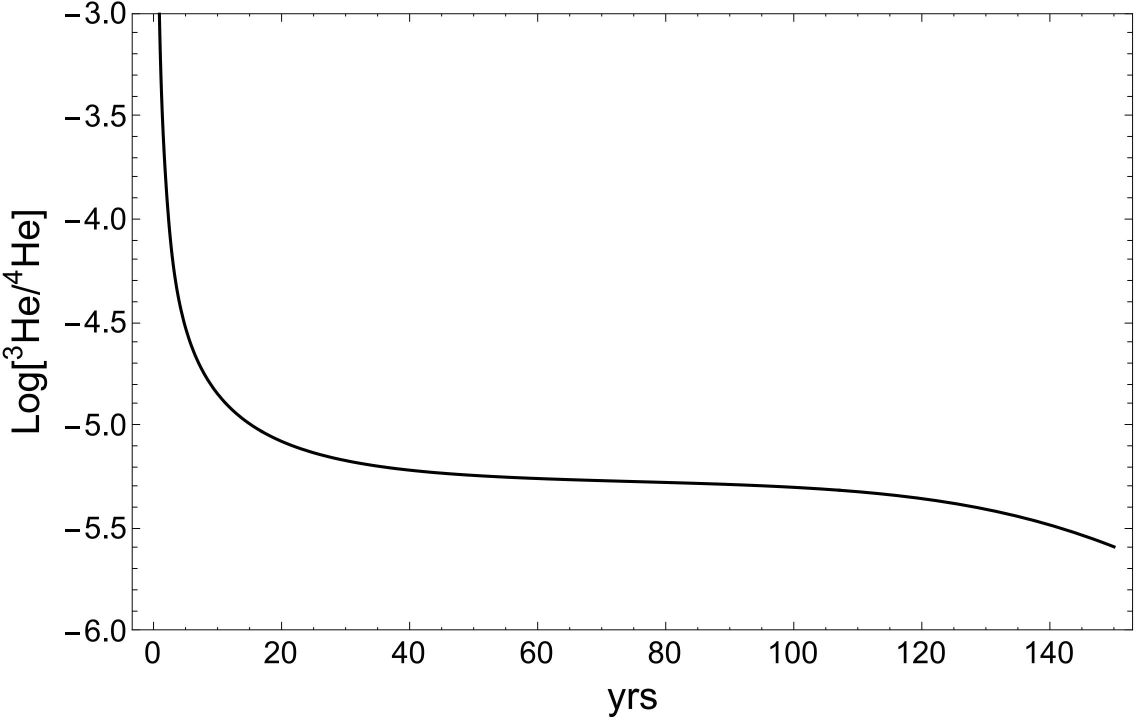
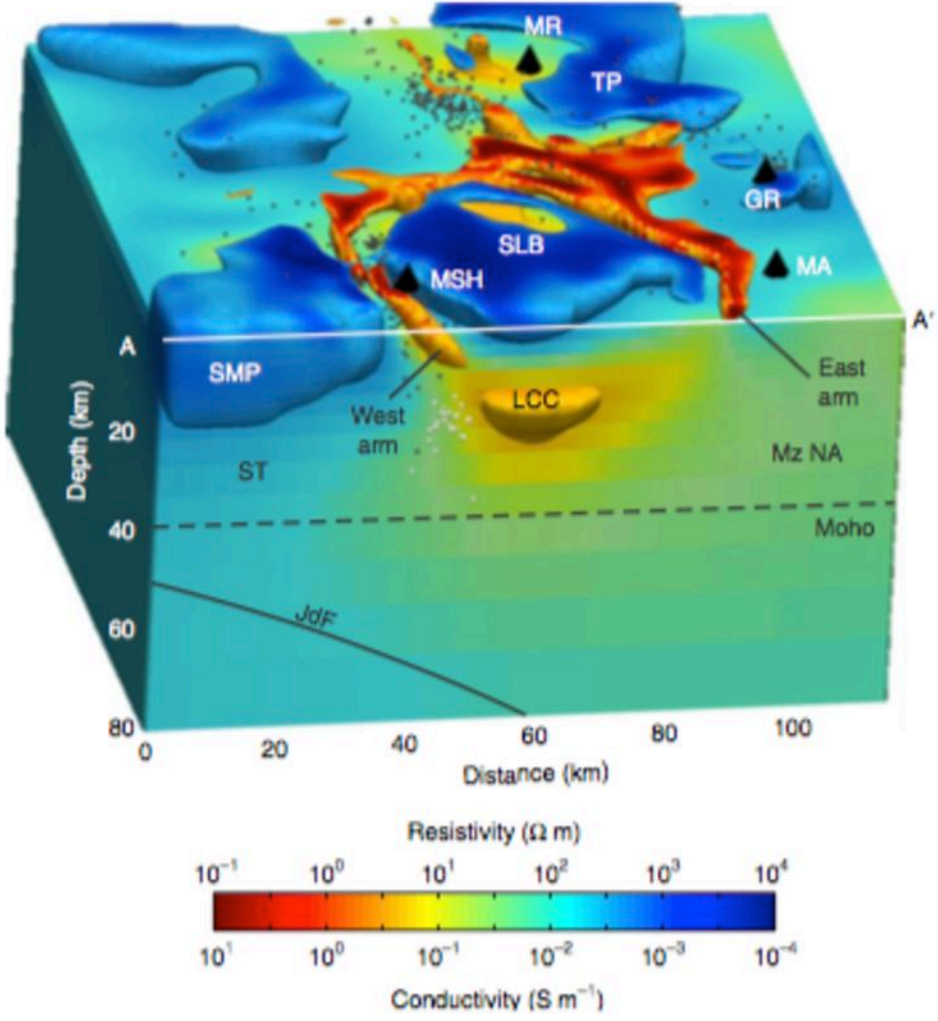
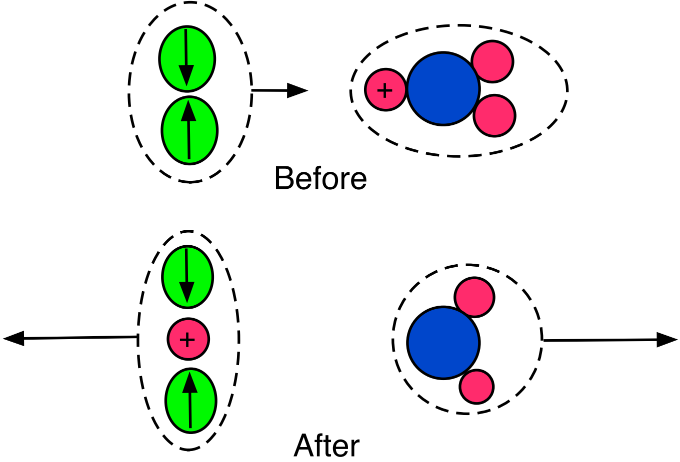

−3.0
−3.5
−4.0
−4.5
−5.0
−5.5
−6.0
0
20
40
60
80
100
120
140
yrs
Log[^{3}He/^{4}He]

Figure 3.



MR
TP
GR
SLB
MA
MSH
A
A′
SMP
East arm
West arm
LCC
Depth (km)
20
40
60
80
ST
Mz NA
Moho
JdF
0
20
40
60
80
100
Distance (km)
Resistivity (Ω m)
10⁻¹ 10⁰ 10¹ 10² 10³ 10⁴
10¹ 10⁰ 10⁻¹ 10⁻² 10⁻³ 10⁻⁴
Conductivity (S m⁻¹)

Figure 4.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