Geomagnetic Extinction: A Paramount Science Disagreement

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One of the most strongly divisive and imminently important issues in science is whether the known geomagnetic excursions of the last 100,000 years are coincident with major climate changes and loss of species. The field is utterly divided, and a resolution is not only academically desirable, but evidence suggests that earth's magnetic field is entering excursion again now, and if this geomagnetic secular variation presents a biosphere problem, the focus and discourse of various fields need a dramatic shift, now. This disagreement was highlighted in February 2021, with major publications claiming both that the Laschamp geomagnetic excursion 42,000 years ago was a major extinction event (Cooper et al. 2021) and expressing doubt (Voosen 2021). Both were published in the same volume 371 of the prestigious journal SCIENCE, they created even more confusion in the field, and it is critical that the next round of academic discussions appreciates the magnitude of the issue, and issues involved.

We often see investigations in this field failing to include a broad enough array of issues. Let's take the example of the well-publicized study in 2020, when it was proposed that the Neaderthal extinction was the result of competition with modern humans, and not abrupt climate change or interbreeding (Timmerman 2020).

The existence of dramatic geomagnetic changes during the Neanderthal extinction is well established (Blanchet et al. 2006; Channell et al. 2017; Korte et al. 2019; Levi et al. 1990; Noel and Tarling, 1975; Svensson et al. 2006), and this was not part of Timmerman's analysis, even though this causal link between the excursions and extinctions has been directly explored via the increase in UV light damage to biological cells and DNA due to destruction of the ozone by solar radiation during the excursion (Valet and Valladas, 2010; Channell and Vigliotti, 2019). These studies and others have found a plausible causation for the extinction. The Valet and Valladas (2010) paper appeared in the same journal as Timmerman (2020), and Channell and Vigliotti (2019) appeared in the #1 geophysical journal - Reviews of Geophysics (AGU) - it was unacceptable to ignore those studies in this context, and yet it is a common feature of analyses in this field.

No study investigating the connection between these geomagnetic events and biosphere stress has considered both climate AND radiation exposure as causes of extinction, they pick one or the other (Cooper et al. 2021 picked climate change), and there are further biosphere challenges during a geomagnetic excursion which also deserve attention in this discussion.

Recent studies have revealed numerous correlations between solar storms/cosmic rays and adverse biophysical outcomes like terminal cardiac events and strokes, multiple sclerosis and autoimmune flare-ups, migraines, seizures, and cognitive/emotional stresses. (Cherry 2002; Jarusevicius et al. 2020; Rozhkov et al. 2018; Shepherd et al. 2018; Stoupel et al. 2018; Vencloviene et al. 2018). The potential dynamics of these biophysical correlations during a geomagnetic intensity minimum have not been explored in the literature, but there is unquestionably more exposure to those stimuli during an excursion, which means that the adverse reactions will be stronger and more numerous.

In a geomagnetic minimum, we should consider the well-understood stresses of enhanced UV-B exposure to microbes and plants, which directly impacts their photosynthetic processes, their progeny (seed integrity), the herbivores that rely on them, and the carnivores relying on the herbivores. Another challenge comes with the loss of predictability and stability of migratory species; both birds and marine creatures (Granger et al. 2020; Keller et al. 2021) use earth's magnetic field. It is reasonable to expect the excursion to negatively affect those species and their immediate superiors in the food chain.

The totality of these challenges, including radiation, bio-electromagnetic coupling, climate changes and competition with modern humans, likely worked as an ensemble of stresses that led to the Neanderthal extinction, that of other hominin species, and numerous megafauna known to have disappeared during past magnetic excursions. These stresses on the food chain could have created further food insecurity and competition between species, such that even the human-competition-effect would be partially driven by the challenges that come with a geomagnetic excursion. Modeling any subsegment of these challenges as independent variables is a considerable error in itself.

Today, the earth's magnetic field is undergoing a well-known weakening and shift of the magnetic pole position. These shifts have been accelerating over the last century, with the polar motion increasing, and the rate of geomagnetic strength now decreasing at 5% per decade, as opposed to 5% per century for much of the 1900s (Dickerson 2014). The recent identification of another acceleration of the field over the pacific sector in 2017 (Finlay et al. 2020) has put the subject in firm focus as a major ongoing event on our planet. Our electrified society, air travel, communications and more have all developed in an age where earth's magnetic field was much stronger than it will be during the zenith of this excursion event. We now have more than the climate, radiation, food-chain disruption and solar-geomagnetic biology connections to consider in this upcoming event- we are at risk of losing our modern, electrified society.

It is a common misconception that earth's last major magnetic event was the famous Laschamp excursion 42,000 years ago, but the Mono Lake, Lake Mungo, and Gothenburg magnetic excursions occurred more recently, along with a minor event known as "Hilina Pali", and one earlier in the timeline that shows up in Vostok corings. These events are fast-flips, rapid reversals, and these occur in a cycle of ~12,000 years. Gothenburg was ~12,000 to 13,000 years

ago, and earth's field is performing the excursion again- right on time.

Looking ahead to the next round of academic studies on this topic, it is imperative that the field give appropriate treatment to all the potential biosphere stresses invoked by a weakening magnetic field and shifting magnetic pole position. This includes (1) the loss of ozone and climate changes, (2) the radiation effect from both extra UV and galactic cosmic rays - on the entire food chain, (3) the navigational disruption to species caused by the magnetic change, (4) the geomagnetic interrelationship with critical biological processes, and (5) the dependence of modern society on electricity, and the increased vulnerability of these systems to both cosmic rays and solar flares while earth has a weaker planetary magnetic shield. The world is watching, and the future may depend on how well we understand these changes and the challenges they present.

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