

# Whole Star Magnetochronology

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**Abstract:** It is presented a seminal paper on magnetochronology to begin the process of dating stars based on their total magnetic fields as they evolve, total meaning whole body, i.e. thermosphere, to surface to core. All portions of the star evolve and the magnetosphere changes as these features evolve on the star. This is to include all stars in all stages of evolution from white dwarf, to blue giant, to Sun-like stars, red dwarfs, brown dwarfs, Jupiters, greys, Neptunes, post-Neptunes, ocean worlds, Earths and even dead mostly solid stars such as Venus, Mercury and Mars. It is important to establish a beginning paper to build on this concept, as the idea of Sun-like stars with whole body features evolving to becoming Earth-like stars with life is rich with work to be done. In fact, it could be argued that figuring out the ages of stars by their magnetic features can lead to a more well-rounded method for determining how much life is out there. In short, a star's magnetic field, coupled with isotopic data, gyrochronology, atmospheric composition, mass, orbital parameters around a host, and other factors can lead us to understand why the Earth has such strange surface magnetic features.

The purpose of this paper is to establish the fact that star's evolve greatly, and this includes both the size, location and intensity of its self-induced magnetic field(s). Following from the General Theory, a general rule of thumb is that the intensity of charged particle motion is higher on younger stars such as the Sun, and weakens as the star evolves, due to decreased motion of charges, near and internal to the star. This means we should expect very old stars to have rather weak global magnetic fields, and dead stars to be almost completely absent them. When there is very little fluid motion to allow for charge to move, then there can be no production of a magnetic field. This means dead stars will not have magnetic fields.

So far, the magnetochronology provided by academics and geologists does not provide a connecting link between young stars to old stars like the Earth. This paper serves as a beginning to link the two on a much larger evolutionary sequence of events, as they are the same phenomenon. This means the surface features of Earth, can have their formation period determined by studying both the orientation of the rocks, and the intensity with which magnetic material was aligned, as well as establishing the internal magnetic events that played a role in their formation. This is of course can help to determine the current internal conditions of younger stars, because Earth is the core of what was once a large gas giant (in intermediate stages of evolution). We can study what is happening in Neptunes and Uranus's interior by studying the magnetic features of the Earth's crust right now and reverse engineering it. As Neptune and Uranus are pre-ocean worlds, 1.1 and 1.2 billion years old respectively.

Magnetochronology can also be applied to younger stars such as Jupiter and Saturn. The strength and sizes of their magnetic fields, in addition to their gyrochronological and isotopic data can determine how evolved their interiors really are. What is even more interesting is that we can provide possibilities for how the interiors form, as certain material is more diamagnetic (repels magnets), and some other material is ferromagnetic and paramagnetic (attracts magnets). One could suppose that the very core of the Earth, and all highly evolved stars are composed of iron because of the stars' electromagnetic properties when they were young.

It is a fun idea to think about, the idea that Earth's iron core was built up over time because when iron interacts with a twisting electric field, it can become a strong electromagnet itself, thus attracting more iron in the center. So it isn't the "iron catastrophe" of dogma that created the core of the Earth, it is the fact that iron is ferromagnetic and can become magnetic itself. Now what would be more interesting is if the iron changes properties when it is compressed to great pressures as it exists in the core. This by far is a more reasonable method for making the cores that exist in long dead stars as Mercury, Mars and Venus. A star forming an iron/nickel alloy core is natural and expected, not catastrophic and unnatural. It also means that we should expect stars that evolved on slow enough timelines to have made quite large iron cores, because they had enough time to collect interstellar shrapnel from other dead stars. So basically the star can sort out elements and molecules it forms by the magnetic properties of the material it collects in addition to other processes. This is probably why we never find pure telluric (Earth made) iron/nickel alloy on the surface, it all has to have come from outside of the Earth, after the Earth sorted it out by its magnetic properties internally.

This makes me think of magnetite and banded iron formations. Those were probably formed when the Earth was late stage Neptune (ocean world), and the total oxygen allowed for the iron to combine with oxygen in large amounts and deposit on the sea bed was increasing. The sea bed for this example would be of course extremely deep, much deeper than Earth's current oceans, probably at least 200 miles or more.

To sum this paper up, all surface magnetochronological measurements need to be interpreted in light of the Earth having been at least 317 times more massive, about the size of Jupiter. We need to think of the Earth's magnetic "pole reversals" in those terms as well, as the Earth was much different than it is now. We are looking at a deep history that extends far beyond Earth's current atmospheric features in pressures, magnetic field properties and temperatures. Almost everything about the Earth was not "Earth-like". We are experiencing the final life sustaining product of a process that is far more alien, and non-human centered than astronomers and/or geologists can admit, and we can see these past portions of Earth's evolutionary history by studying the exoplanets that are much more massive, as well as their even younger counterparts, the stars themselves. It is my hope that one day humans will once again put aside dogma in favor of a new understanding of life and the universe.

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