THE ORIGINS OF THE EARTH

Some would argue that this question does not fall within the domain of the geologist. He would be lacking the requisite skills to properly probe this particular scientific mystery. It would be more appropriately answered by an astronomer. Fortunately, I possess the requisite capabilities to enable me to implement an analysis.

The presentation of this paper will prove to be somewhat "delicate". Although it is, obviously, intended for geologists, it is imperative that astronomy theory be introduced as a direct result of what was outlined in the initial paragraph. Consequently, there will be the attempt to introduce a sufficient amount of astronomy theory to enable the geologist to comprehend this paper.

When answering this query, it is not merely a question of contending with the origins of the earth as this would entail too simplistic an analysis. The question to be probed pertains to the origins of the solar system in its entirety.

In my view, there is one critical clue which will substantially facilitate the answer to this question. This pertains to the fact that all ninety two naturally occurring elements are found on earth. Why does this constitute a clue? Within astronomy, there is only one phenomenon which culminates in the creation of higher elements beyond iron. The phenomenon in question would be a supernova. Without getting overly technical, this entails a star that has exhausted its internal fuel and has reached the end stage of its existence. As a result of the physics of this system, the star explodes. It is in the course of this explosion that all of the natural elements are created. This would imply that the origins of the earth (and more generally the solar system) was the culmination of a supernova explosion in the distant past. Although this would (presumably) be accurate, it would also be simplistic.

In astronomy, stars are divided into population I stars and population II stars. (It is irrelevant to this paper to discuss the dichotomy between the two.) However, there are also population type III stars which do not (necessarily) play a part in contemporary theory. These are stars which permeated the early universe. Their primary distinguishing feature (as compared to stars of a later generation) is that they were significantly more massive. This fact is germane to this paper for the following reason. Population I and II stars would not be sufficiently massive to give birth to an entire solar system should they explode as a supernova. However, if population type III stars were sufficiently massive, there would be two ramifications to this. Firstly, they would be sufficiently massive to *ensure* that they eventually culminated in supernova explosions*. Secondly, and far more importantly, at least some of these stars would possess the requisite mass to give birth to our solar system.

Since a geologist would be oblivious to stellar dynamics, certain specific aspects of supernova will be covered here. As was previously written, prior to a star becoming a supernova, it has exhausted the internal supply of fuel which enables it to produce energy. At that stage, its chemical composition is as follows. The core is comprised of iron. Outside of this core is a layer of silicon and sulphur. Next, is a layer of neon and

* Only stars of a certain mass will end their lives in a supernova explosion.

magnesium. The next stratum is comprised of carbon, neon, and oxygen. The outer layers are comprised of helium, and finally, hydrogen.

Exactly how massive a star would have to be to culminate in the creation of our solar system is of a highly speculative nature. However, there is a reasonable probability that a sufficiently massive star with this chemical composition could create our solar system when it went supernova. One reason for this statement is as follows. The outermost layer is comprised of hydrogen. In accordance with existing stellar theory, the fuel element of (what is known as main sequence) stars is hydrogen. Therefore, when the sun formed, it must have been predominantly comprised of hydrogen. Let's postulate that in the distant past there was a massive population type III star well beyond the "scope" (in terms of distance) of Pluto. When it exploded as a supernova, the "entity" which formed furthest from it would have been predominantly comprised of hydrogen (with the inclusion of other elements created in the supernova). This "entity" would have been our sun. The chemical composition of a star prior to it becoming a supernova is commensurate with the structure of our solar system. The sun is predominantly gaseous while the planets are lithospheric. (The obvious exceptions to this would be Jupiter and Saturn as they are predominantly gaseous. However, this paper will explain these two anomalies.) As we proceed from the outer layers of a supernova to the inner layers, the chemicals make the transition from gases to solids. The quantity of solid elements would have been dramatically increased once the actual explosion transpired. Consequently, with the outer layers being predominantly gaseous and the inner layers predominantly solid in nature, the following conditions would have prevailed upon the supernova explosion of a population type III star.

There would have been various vortices of energy being hurled into interstellar space. If one is to develop a theory which is consistent with the nature of our solar system, then the following would be postulated. The vortices which formed the planets would have been comprised predominantly of solids with minimal mass (again, with the noted exceptions of Jupiter and Saturn). However the vortex which became our sun was significantly more massive and predominantly comprised of gases. As they continued through space, they would lose energy and, subsequently, velocity. However, how exactly did these vortices culminate in the birth of our solar system?

When dealing with the history of the universe, when population type III stars went supernova, there are various possibilities as to what would transpire with these types of vortices. One possibility is that they would have been "consumed" by other population type III stars. In other words, they may have proceeded straight into another star and become part of its composition. Or, they may have come within proximity of a star just when it exploded and lost all cohesion in that manner. However, in order to explain solar system formation, I present the following.

Firstly, the geologist must not assume that these vortices would have "stopped" on their own (despite the loss of energy as they travelled through space). This is simply because of Newton's first law of motion. There must have been some force acting upon them in order to cause them to stop and form our elliptical solar system. Although there have been (relatively) recent discoveries of various types of energy in the universe (dark energy, and dark matter), I doubt very much if this had any bearing on early formations within the universe. However, when dealing with gravity which is independent of these discoveries, then the gravity induced by the earliest stars may suffice to explain how these vortices of energy created our solar system (and possibly others as well).

Two paragraphs ago, it was stated that these vortices may have been "consumed" by other population type III stars. However, what would transpire if they did not proceed straight into a star, but instead, came within the gravitational "range" of one of these early massive stars? For solar system formation to take effect, there would have been two necessary prerequisites. Firstly, the vortices would have to be at a (reasonably) specific "range". They could not have been too close, otherwise they would have been drawn into the star and consumed. However, they could not have been so far as to prevent the star's gravity from affecting the system. In conjunction with this, the system would have to be sufficiently far away so that when this star exploded as a supernova, the system would have remained relatively unaffected (i.e. not blown up by the enormous explosion). Secondly, the vortices would have to lose a sufficient amount of energy to the vacuum of outer space so that their velocity was low enough that when they came within the appropriate "range" of one of these massive stars, they would have been influenced. To be more specific, their velocity could not have been so substantial that the gravitational effect of the star would have been negligible. If these two prerequisites had been in effect, then solar system formation would have been effected via the following.

Firstly, the linear acceleration of the first vortex (that would have eventually become the sun) would have slowed and been drawn (slightly closer) towards this star. One by one, the other vortices would have been influenced in the same way. However, these vortices would have had two gravitational influences affecting them. Firstly, the massive population type III star, and secondly, the precursor to the sun. In assuming an elliptical orbit, the gravity of the population type III star would have drawn them towards it. However, the gravitational effect of the sun's precursor would have prevented them from being drawn any further to the population type III star. The sun's precursor would have caused them to be drawn away from it. Therefore, a careful balance between the gravity of the population type III star and the sun's precursor would have achieved the elliptical orbits of the planets of our solar system.

Although this theory explains the formation of the solar system, what about the formation of the earth? Prior to outlining this, there is still some theoretical postulating to implement. As previously stated, the smaller vortices would have been predominantly comprised of solids. However, this statement is rather simplistic in nature. A more precise statement is that they were comprised of elements which would have eventually become solids. When they were initially ejected from the supernova, they would have been in a gaseous state. This was the result of the enormous amount of initial energy that would have been contained therein. (In case the geologist is wondering how these gaseous vortices maintained their cohesiveness without losing their mass to space, there are two answers to this question. Firstly, these vortices would have been significantly larger during their initial stages upon ejection from the supernova. As they travelled through space, they would have lost much of their mass prior to finally becoming "established" for the formation of our solar system. Secondly, centripetal force would have maintained their cohesiveness and prevented the dissipation of the gases.) Once these vortices were in their orbits, this would have obviously meant that their linear velocity had ceased (that is from the time that they were initially ejected from the supernova). This means that the primary energy that each of these vortices would have been experiencing (as the result of motion) would have been the result of their own centripetal force (the energy experienced as a result of orbiting around the sun would have been negligible). Since there was no longer any energy being derived from linear acceleration, a "cooling effect" would now have taken effect. This would have induced much of the gasses to make the transition to the liquid phase. The primary basis for this tenet is as follows.

The development of *any* scientific theory must be consistent with observations. Although the purpose of this paper is to explain the origins of the earth, it has already been previously stated that the broader question pertains to the origins of the solar system. Consequently, in the development of said theoretical framework, how would the formation of planetary satellites be explained? Regrettably, at this stage only the broadest explanation can be proffered.

The one primary observational fact we have to guide us, is the correlation between planetary mass and the quantitative number of satellites. The two tend to be proportional to one another. Consequently, the *broad* explanation behind satellite formation is as follows. The greater the mass of a vortex, the greater its internal energy. This would have resulted in a rather "chaotic" internal milieu within the vortex. Within nature, violent "uprisings" are known. Within geology, the most obvious one would be volcanoes. When dealing with the sun, there is a phenomenon known as prominences which entails an energetic "uprising" (loosely speaking) of energy from within the sun. Until internal chaotic energy (and the subsequent release of this energy) is better understood, we will be confined to a vague description of satellite formation. In the early history of large planetary formation, the liquid precursor to a planet was subject to periodic times when the requisite internal energy was focused in one specific area so as to induce an "uprising" of material within the area. For satellite formation to take effect, the velocity of the ejected material would have to have been reasonably "specific". On the one hand, it would have to be sufficient in magnitude as to induce a sufficient centripetal force to maintain the cohesiveness of the mass. (Centripetal force would have been imparted to this mass as a result of the significant rotation of the planetary precursor.) On the other hand, its velocity could not have been so significant as to achieve escape velocity (the velocity a mass requires to escape the gravitational attraction of a body). If these parameters had been conformed to, satellite formation would be (broadly) explained. (Until there is more substantial theory/data on chaotic energy and possible "uprisings", this is the best I can do for the time being in relation to satellite formation.)

As previously stated, the anomalies of Jupiter and Saturn must be explained for the cohesiveness of this paper. Although their atmospheres are predominantly gaseous, they possess a solid core which is significantly more massive than earth. An explanation to explain this anomaly is as follows. When the supernova that gave birth to our solar system exploded, there was such a substantial amount of hydrogen and helium in the outer envelope that all of the subsequent vortices (that is the precursors to the planets) absorbed hydrogen and helium in their atmospheres. However, due to the low mass of most of the planets, these gases achieved escape velocity and dissipated into outer space. However, there were two factors which maintained the gaseous nature of Jupiter and Saturn. Firstly, there was their significant mass which established a very high escape velocity and negated the dissipation of these gases. The second factor is that the bulk of the hydrogen surrounding these planets is comprised of liquid metallic hydrogen. This is comprised of protons and electrons in a highly ionized state but at high pressure and low temperature (at least a lower temperature than what we find in the sun which is where a substance of this nature is usually found).

With this extensive background, explaining the formation of the earth becomes relatively simple. In the early days of the planet, the outermost gaseous layers were largely comprised of oxygen and hydrogen. As time went on energy would have been lost to space and a "cooling effect" would have taken place. Once the requisite level of cooling had taken effect the liquid precursor to the lithosphere would have solidified. Furthermore, the oxygen and hydrogen would have chemically combined to form water. This would have caused *lengthy* periods of rainfall. Since it is postulated that this initial rainfall was the source of earth's ocean, it is not unreasonable to state that the precipitation would have taken place over a period of a few years. At the very least, it would have lingered for several months.

The rest of this paper will deal with potential opposition to what has been espoused herein.

One significant point of opposition would pertain to the initial population type III supernova explosion. The inherent nature of an explosion would imply some degree of "symmetry". To be more precise, various solar systems should have been created as a result of this supernova explosion. There are two answers to a critique of this nature.

Firstly, this initial explosion may very well have culminated in the requisite material for the development of other solar systems. However, this paper has adopted the position that other precise physical criteria must be in effect in order to ensure solar system formation. Other material may have been consumed by other stars. Alternatively, they may never have come within proximity of another star's gravitational effect so as to induce a slowing of their movement and solar system formation. Another possibility is that even if they did come within proximity of another star, their linear velocity was not slow enough to enable the star's gravity to induce the requisite effect. Therefore, they would just continued to travel through outer space until all of their energy/material was dissipated away. Yet another possibility is as follows. Other solar systems *did* form yet they are beyond our current observational capability.

If what has been delineated in the previous paragraph is accurate, then the most probable explanation for why we have not observed other solar systems within proximity of ours, is that the precise criteria required for solar system formation was not in effect.

The second possible response to this critique is as follows. At the time that the star went supernova, it may have been experiencing a phenomenal rate of rotation. If this were the case, the ramification of this would have been as follows. At the specific time of the explosion, the vast majority of the star's material would have been focused in a specific direction. In other words, the star's momentum would have induced the majority of the material to be ejected in one unilateral direction. Whatever material was left would have been drawn into the black hole (current theory dictates that if a star of sufficient mass goes supernova, the remnant will be a black hole). This would also explain the anomaly of a "symmetrical explosion" and the failure to observe other solar systems within our proximity.

Of these two possibilities, I feel that the explanation just offered in the preceding paragraph is the most probable explanation behind the initial critique.

There would be a second ("foreseeable ") criticism which would be of a far more substantial nature. There are various elements of this theory which seem a bit too "precise". Firstly, these vortices coming within a reasonably precise proximity of another population type III star to induce the correct gravitational influence *and* at the correct velocity. Furthermore, our own planet having the appropriate amount of oxygen and hydrogen in the early atmosphere so that when the planet began to cool, the earth would be covered with water. It *almost* seems like a supreme deity is being invoked to explain a remarkable set of coincidences in relation to the formation of our planet, and the eventual development of life on this planet.

"Within physics", a concept of this nature is referred to as the anthropic principle. The reasons for placing the words within physics in quotation marks is as follows. Personally, I have *never* heard of this concept in a lecture, or a colloquium. Furthermore, I have never personally read a paper with this concept being espoused. I have become cognizant of it via popular physics books whose specific target market is the lay reader. Consequently, I'm dubious as to just how vital a concept it actually is. What it basically entails is the need to explain why the universe is so finely "tuned" for the support of life. To be more specific, if certain physical parameters were even *incrementally* different, life would not have developed. How can a scientist explain this *without* invoking a supreme deity?

I personally feel that the anthropic principle is utterly erroneous in nature. My opposition is rooted in two tenets.

Why is the universe so "ideally" suited for the development of life? Are we human beings to be so utterly conceited as to believe that any and all life in the universe must be (somewhat) similar to our own? There is nothing even remotely unrealistic about stating that there is life elsewhere in the universe which is completely dissimilar to us. For all intensive purposes, this life wouldn't bear any resemblance to us, or any other life forms on earth. To delineate this concept one step further, the following will be stated. *As far as we know* the laws of physics are the same throughout the universe. There is no difference between the behaviour of light here on earth and the behaviour of light on a planet billions of light years away. Can we state the same for biology? We are oblivious to the precise answer to this question. However, it is not unreasonable to state that life on other planets is utterly removed from life on this planet. Is DNA the blueprint of life elsewhere? It's quite possible that the science of biology, as we know it on earth, is non-existent on distant planets.

One small element to exemplify this is the following. Life on this planet required billions of years to evolve and develop. Can we be so arrogant as to believe that it "had" to be the same on other distant planets? What is there to prevent the development of life elsewhere over a period of centuries, possibly even decades? The *sole* factor which "prevents" such a possibility is human arrogance and conceit. To take this one step further, let's assume that the requisite physical factors of the universe which enabled *our* emergence were not in effect. That doesn't necessarily mean that life could not have evolved in the universe. It simply means that human beings (and other earth life forms) would not have emerged. That doesn't mean there wouldn't have been life.

My second tenet for opposing the anthropic principle is more germane to this specific paper. It's explained as follows. (The reader should be forewarned that this will *seemingly* contradict the previous precept. However, I believe I will appropriately fortify my position.) There are scientists who claim that there simply must be life elsewhere in the universe because the universe is so very large. In this assertion, these scientists are overlooking something. It is possible that the only reason we're here, is *because* the universe is so very large. Although I staunchly stand by the tenet that was stated two paragraphs ago, in science we must consider all *viable* possibilities if we hope to one day arrive at the truth. To this end, it is (realistically) possible that the universe is indeed inhospitable to life. However, *if* this were the case, that doesn't necessarily mean that life cannot develop. It would be comparable to invoking that tired old cliché of an inordinate number of monkeys sitting at typewriters. If there were a sufficient number of them, one of them will type out Shakespeare. In that same vein, when dealing with a universe which is as large as ours, there doesn't "have" to be life elsewhere. Maybe the only reason we're here is *because* the universe is so very large. In this same vein, although the prerequisites for solar system formation seem to be highly precise, solar system formation is not necessarily improbable given the inordinate size of the universe.

In general, the anthropic principle simply does not appear to be meritorious.