Magnetized moon rocks, impacts, and the Precambrian—a response to Humphreys

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This responds to the recent paper by Humphreys[1] proposing that accelerated radioactive decay, Precambrian rock formation, and impacts were all occurring in the pre-Flood period. However, the scale of these processes makes them unrealistic for the pre-Flood period. Also, other scenarios are possible and should be considered by creationists. Much Precambrian rock formation could have been in the Creation Week, as could some impacts. Humphreys suggests the magnetic decay on the moon is related to the radioisotope age but this has not been clearly established.

In *J. Creation* 28(3)[1] Dr D. Russell Humphreys proposes a scenario for integrating data relating to remnant magnetism in moon rocks with accelerated radioactive decay and Precambrian rocks on Earth. Though I have great respect for Humphreys and his many contributions to creationist research, I find his scenario premature, at least, and perhaps very unrealistic. I would like to suggest that other scenarios be considered. I have recently changed my point of view regarding impacts and this may have relevance to the issues Humphreys is addressing. There is also other recent work that I feel must be mentioned since it could have important implications. I want to commend Humphreys for addressing the issue of reconciling the magnetic data, the radioactive decay data, and the impact data. There is a need for research and discussion on these questions among creationist researchers.

Impacts on Earth and the solar system

I will begin with how my own view of Earth and solar system impact cratering has changed. Beginning with papers[2,3] presented at the International Conference on Creationism (ICC, 1998), I argued for impacts from space taking place on Earth during Noah's Flood, although at that time I felt it was not clear what the number of impacts would have been for Earth. But recent papers by Oard[4,5] and Spencer[6] examine crater data for the moon as a basis for estimating the number of Earth impacts. Earth is a much bigger and more massive target than the moon. Therefore it stands to reason that there should be more impacts on Earth than the moon. I proceeded on the assumption that the earth should not be treated separately or as special regarding impacting objects in the solar system. Oard estimated Earth received on the order of at least 36,000 impacts. This was based on statistics with the smallest craters being of approximately 30 km diameter, the largest being about 300 km diameter, and Oard estimated for larger sizes.[4] I later updated that estimate to 58,000 based on data from the Lunar Reconnaissance Orbiter (figure 1).[5] At the ICC in 2013 there was a very significant panel discussion on impacts. The possibility of impacts on the fourth day of Creation Week was brought up in that panel discussion. Dr Danny Faulkner then put forward the Day 4 impact hypothesis in a paper published online in *Answers Research J.* (ARJ) on 22 January 2014.[7] I then published a response to Faulkner in the ARJ on 10 September 2014.[8] I am now convinced that the Day 4 cratering hypothesis is the most reasonable view of impact cratering.

The Day 4 cratering hypothesis proposes that many thousands of impacts could have taken place on Day 4 as a part of God's creation of the moon and other solar system bodies. But these impacts during Creation Week would not have taken place on Earth.[7,8] This would then imply that the impacts that took place during Noah's Flood were part of a separate event that involved a much smaller number of impacts. Thus by this view there were two episodes of impact bombardment, one outside Earth on the fourth day of Creation Week and another on Earth at the time of the Noah's Flood. Faulkner also proposes that solar system moons and planets were formed on the fourth day of creation from small particles or objects created on Day 1 of Creation Week. Adopting this view represents a change in my perspective.

First it puts impacts before Noah's Flood, which was an idea I resisted. I took the view that the Creation Week was an inappropriate time for impacts. But now I would view impacts as just another process God used to form the surfaces of objects in the solar system. But this would not apply to Earth because tens of thousands of large impacts would threaten life on Earth too much and have many severe effects. I concluded that the number of large impacts makes it impossible to have all the impacts during Noah's Flood. The same problem remains if impacts are merely spread out over the pre-Flood period, or if impacts took place beginning at the Fall. It seems an inescapable conclusion to me now that whenever the impacts took place, God supernaturally

protected the earth. Earth must be treated as a special case among the planets regarding impacts. Earth was certainly treated as special in the Creation Week since it was made first. I do not believe Scripture rules out the possibility of impacts occurring outside Earth in the solar system on the fourth day of creation.[8] On the other hand, it simply will not do for life on Earth to be threatened from impacts in the Creation Week. The fourth day impacts hypothesis answers these concerns.

Regarding Humphreys' comments on impacts, I am puzzled as to how many impacts Humphreys believes took place on Earth. He refers to a number of 5,000 craters for the moon, 20 km and greater in size. But what about Earth? Humphreys doesn't make clear his thinking on this. Even taking 5,000 as the number of impacts on Earth, the effects during the pre-Flood period would have been very severe because these are not small impacts. Besides, 5,000 is an unreasonably low number for Earth. Only about 184 identifiable sites are known on Earth today.[6] The crater statistics based on lunar data do not include the largest craters on the moon such as the large mare basins on the near side. Could these also happen on Earth? Could an impact the size of the Aitken Crater (figure 2) happen on Earth (2,500 km diameter)? It becomes implausible because of the number of large craters. It is after years of thinking about the scale of the impacts problem that I have changed my perspective.

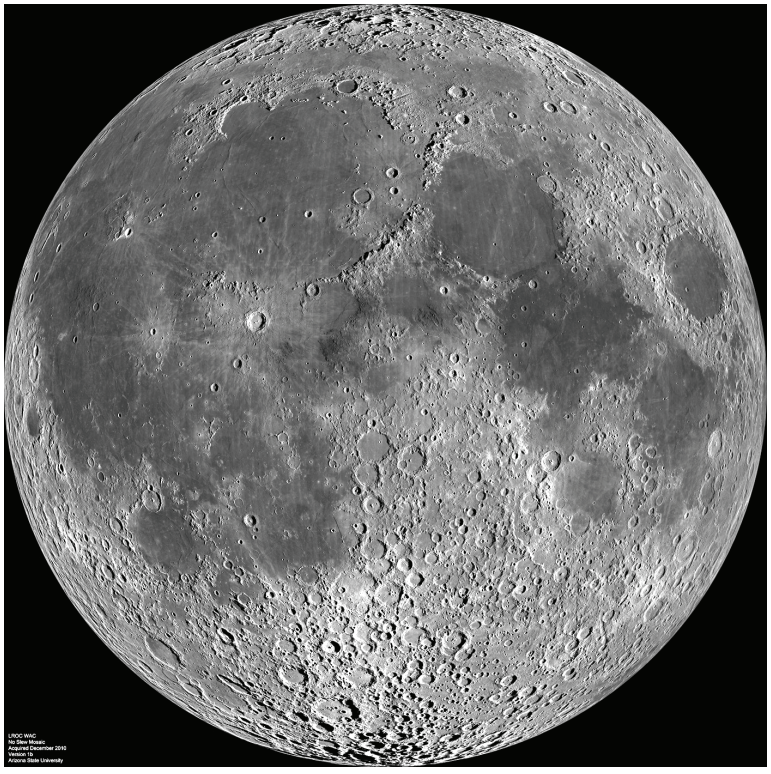

Figure 1. Nearside of the moon. Mosaic from the Lunar Reconnaissance Orbiter, from 2010.

Magnetic lunar samples

The relevant question in Humphreys' paper is: how are impacts on the moon related to magnetized lunar samples and radioactive decay? Many *Apollo* samples are related to the Imbrium basin or one of the smaller craters around its periphery. Thus *Apollo* samples in many cases date to about the time of the formation of the Imbrium impact crater, or the lava flows that followed it. (This does not mean the impact really drove the volcanism but merely that the fractured crust allowed lava to reach the surface easily.) These lava flows often originated within the large craters. The magnetization in the lunar samples was 'frozen' in at the Curie temperature as the rock cooled. Therefore the magnetization of the lunar samples is clearly related to the rock formation on the moon. But it is not necessarily the case that the magnetization of the samples is correlated to the radioactive age of the samples. I do not believe Humphreys has made a strong case for a correlation of the magnetic age with the radiometric age. This correlation should be more well established.

Dr Andrew Snelling (who was also involved in the RATE research project) has recently published papers online with the *Answers Research J.* related to radioactive dating of meteorites.[9,10] Though somewhat tentative, Snelling's analysis suggests that accelerated radioactive decay may not have taken place outside Earth. Snelling points out that there is no consistent pattern related to the atomic weight of the isotopes as was observed in the RATE study among the radioactive isochron dates of meteorites. Thus Snelling suggests that daughter isotopes present in the meteorites may be primordial; that is, they were created and not from radioactive decay. Note that this was regarding meteorites, not lunar samples, collected by *Apollo* astronauts. It remains to be seen what the so-called 'lunar meteorites' may indicate about accelerated radioactive decay. There are known meteorites found on Earth that have compositions matching known areas on the moon; these are the lunar meteorites.[11] Impact physics certainly makes it plausible that small ejecta could leave the moon's gravity and then later fall onto Earth. If Snelling's conclusion is born out this would be a significant problem for Humphreys' scenario. Without accelerated radioactive decay the moon's core may not melt if it were created initially solid. Furthermore, the radioactive ages for the lunar samples would not validly correlate with magnetic data. It would mean there may not be a simple way to take radioactive dates as a valid 'relative'

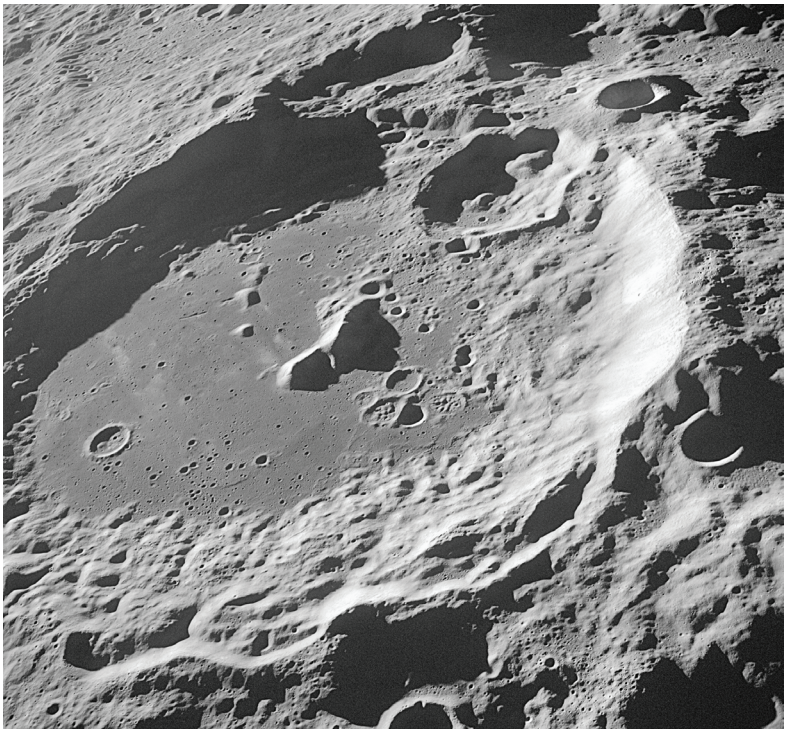

Figure 2. Oblique view ofthe Aitken crater from Apollo 17.

time marker between Earth and solar system bodies outside Earth. It is not clear to me that radioactive age dates for lunar samples correlate with radioactive dates from Earth rocks, even if they give the same age result. I think we have to say that as yet this correlation has not been really established, but merely assumed by some creation researchers.

To be clear, I accept the conclusions of the RATE research for the evidence on Earth documented in the RATE study. I also accept Humphreys' magnetic model as valid. Humphreys' geomagnetism model seems to work well for a wide range of objects in the solar system. But I would suggest creationist researchers be cautious about assuming that moons or planets outside Earth can be treated the same as Earth.

The lunar core

Humphreys has a good discussion of the moon's core, its conductivity and how the range in the conductivity could affect the decay time for the moon's magnetic field. I do not dispute any of Humphreys' information in this section but I would like to emphasize there are a number of possible scenarios for how the moon's core could have started at creation and then come to how it is now. Some might suggest other possible mechanisms for causes of remanent magnetism on the moon. But secular lunar scientists have explored other mechanisms for years because it is well known that there are difficulties explaining the magnetic lunar samples and lunar magnetic anomalies. I do not believe other mechanisms can adequately deal with the evidence. The moon must have had its own magnetic field at one time. The magnetic field of the moon could have decayed away before the Flood or possibly might have lasted till after the Flood. When I use a lunar core radius of 360 km in Humphreys' equation (1), only about 10% larger than Humphreys' value of 330 km, I arrive at a decay constant of 784 years. (Recall that the decay constant is equal to the natural logarithm of 2 divided by the half-life.) This would mean the moon's field would still exist but be very weak by the time of the Flood. One recent study

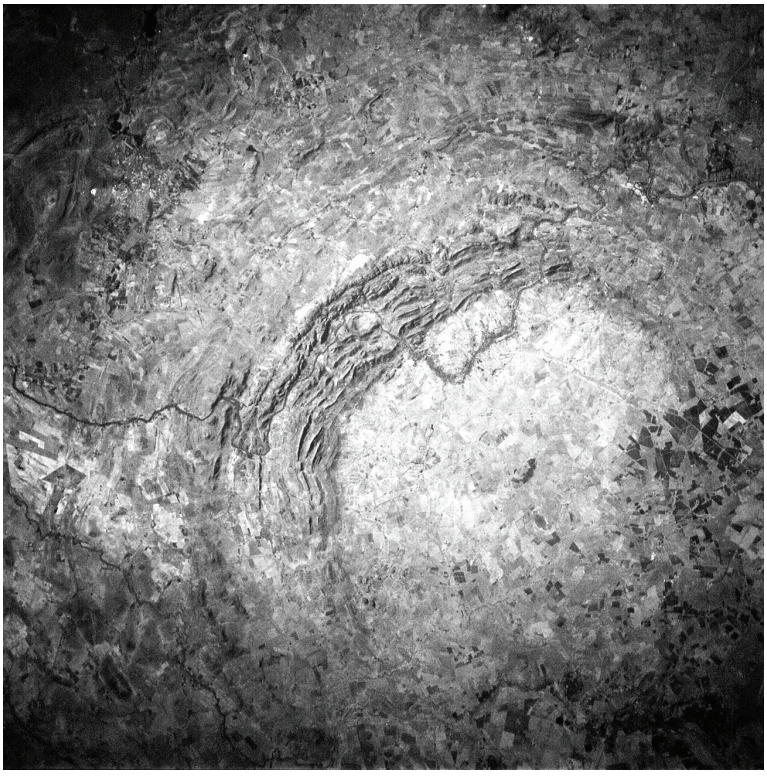

Figure 3. The Vredefort dome structure is in South Africa and has a uniformitarian age of approximately 2 billion years.

measuring the size of the lunar core arrived at an upper limit of 400 km.[12] Thus, there could be multiple possible scenarios for the decay of the moon's field. Did the lunar core start with a molten outer core at creation and partially cool or did it start solid and then melt? Humphreys is suggesting the latter and treats the moon's core as very similar to Earth's. This is fine as an approximation, but other scenarios should be explored.

Precambrian rock

Humphreys has a discussion of Earth's Precambrian rock in relation to his scenario. He suggests Precambrian rock was forming after Creation Week during the pre-Flood years. This is potentially the most unrealistic aspect of Humphreys' scenario. The problem is one of scale. I would not want to live in the pre-Flood world Humphreys describes. The pre-Flood world, it seems to me, should be a quieter place. In Humphreys' paper, the amount of geologic activity proposed in the pre-Flood world would seem very hazardous for life, with geologic events as well as large impacts all taking place. Note that Earth impact craters found in Precambrian rock do not necessarily mean that the impact occurred when the rock formed. The impact could have occurred sometime after the rock formed if that rock were on or near the surface. Thus the Precambrian rocks where the Vredefort or Sudbury impacts (figure 3) are found could have formed in the Creation Week, such as possibly on the third day, but the impacts may have taken place at the time of the Flood. I am not a geologist but I find Dickens and Snelling's harmonization of Precambrian geology and the Bible[13] plausible in most respects, though there are a number of details that need more research. Their proposal would put most Precambrian rock as forming in the Creation Week, whereas I suspect some Precambrian rock did form in the Flood. But the volume of Precambrian rock would suggest that it's unrealistic for all of it to have formed in the pre-Flood period or in the Flood itself. It is a problem of scale, somewhat like the impacts problem.

Conclusions

I would argue that much Precambrian rock formation on Earth and impacts on the moon likely happened in the Creation Week, as described above. There is, however, a need for more research on the origin of Precambrian rock. Decay of the moon's magnetic field could have continued through much of the pre-Flood period with few ill effects on life. But this is not the case regarding accelerated radioactive decay or Precambrian rock formation on a large scale. There is a need for creation researchers to deal with meteorite radioactive ages, especially those of the lunar meteorites. If some radioactive daughter isotopes associated with uranium or potassium decay were created this could have many implications for integrating the magnetic data on the moon with radioactive decay data and with the Precambrian rock record on Earth. I would now hold to the fourth day impacts scenario much as Faulkner has suggested. The magnetic data from lunar samples and meteorites does need to be related to radioactive decay data but as yet it is unclear how to do so in my opinion. Thus I would suggest more research before accepting Humphreys' hypothesis. More debate on these issues is welcome and appropriate.

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