4 Vesta, achondritic meteorites and Flood bombardment

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Naturalistic planetary scientists assert that achondritic (i.e. basaltic) meteorites found on Earth were derived from the third largest asteroid in the asteroid belt—4 Vesta. However, two new studies of several purported 4 Vesta meteorites suggest that they were derived from Vesta-like bodies in the inner asteroid belt. The asteroid belt continues to eject materials, some with Earth-crossing orbits, and it remains the most logical source for materials that impacted Earth with the onset of the Flood.

Earth's crust contains many impact craters. While questions remain regarding the type of materials (rock, metal, or ice) that created them, many young-earth creationists believe that these impact events began at the onset of the Genesis Flood.[1–18] Debate still remains regarding the source of the impact materials and the above references contain much discussion and information on this issue.

I have previously proposed that the extraterrestrial material that impacted Earth, beginning with the onset of the Flood and diminishing thereafter, was derived from the asteroid belt (as evidenced by Kirkwood Gaps and ongoing meteor falls), located between Mars and Jupiter (figure 2).[7,11] Two recent articles[19,20] provide additional evidence for this proposal, suggesting that the asteroid belt may be ejecting basaltic objects into Earth-crossing orbits from areas previously unidentified.

Achondrite meteorites

Naturalistic planetary scientists have long recognized that achondritic meteorites are derived from the third largest asteroid in the asteroid belt—4 Vesta (figure 3).[21] This object is approximately 530 km in diameter and has a mass of approximately 3.0 x 10^{17} metric tonnes.[22] Over time, it has been impacted by other objects in the asteroid belt creating smaller achondritic asteroids, some of which have Earth-crossing orbits (figure 4).[23] Meteorites derived from 4 Vesta are identified as howardites, eucrites, and diogenites (HEDs).[19,23] Recent work designed to confirm the trajectory of these 4 Vesta meteorites has revealed an unanticipated discovery.

Desert fireball network

Observing a fireball crossing the nighttime sky or finding a meteorite on the ground does not provide a means of determining the likely direction or source of that object from space. Recognizing this, planetary scientists have constructed dedicated observing networks designed to triangulate fireball trajectories and determine orbits and fall position. One such network is in the Nullarbor Desert in Australia.[24] A recent fireball recorded on July 20, 2007, resulted in the discovery of the Bunburra Rockhole meteorite—a brecciated eucrite.[24]

Anomalous basaltic meteorites

An analysis of this meteorite revealed that it has an unusual oxygen isotope composition—different from other meteorites believed to have been derived from 4 Vesta. This was not the first basaltic meteorite to have this unique variation as six others collected around the world have a similar oxygen isotope composition.[25]

The result of the investigation into the Bunburra Rockhole (BR) meteorite determined that this object and the six others were likely derived from a similar parent body:

> "In the case of BR, compositional as well as orbital data indicate that basaltic asteroids unrelated to 4 Vesta reside in the innermost main belt, and these bodies are delivering material (most likely via the v_6 resonance) into Earth-crossing orbits."[26]

In a separate study of several basaltic meteorites with anomalous oxygen isotopic compositions, a group of naturalistic planetary scientists determined their common source was from up to five distinct Vesta-like parent bodies.[20] Many of these basaltic meteorites were unbrecciated, suggesting a unique origin:

Illustration by NASA/JPL-Caltech

Figure 1. The onset of the Flood would have initiated the extraterrestrial bombardment of Earth. The greatest number of impacts would have occurred early during the global Flood (i.e. Lower Flood Event Division). Objects sourced from the asteroid belt (and largely from Kirkwood gaps) would have traveled into Earth-crossing orbits and impacted Earth's surface. The majority of the space objects would eventually be swept from Earth's orbit, decreasing the number of meteorite falls to levels we find today.

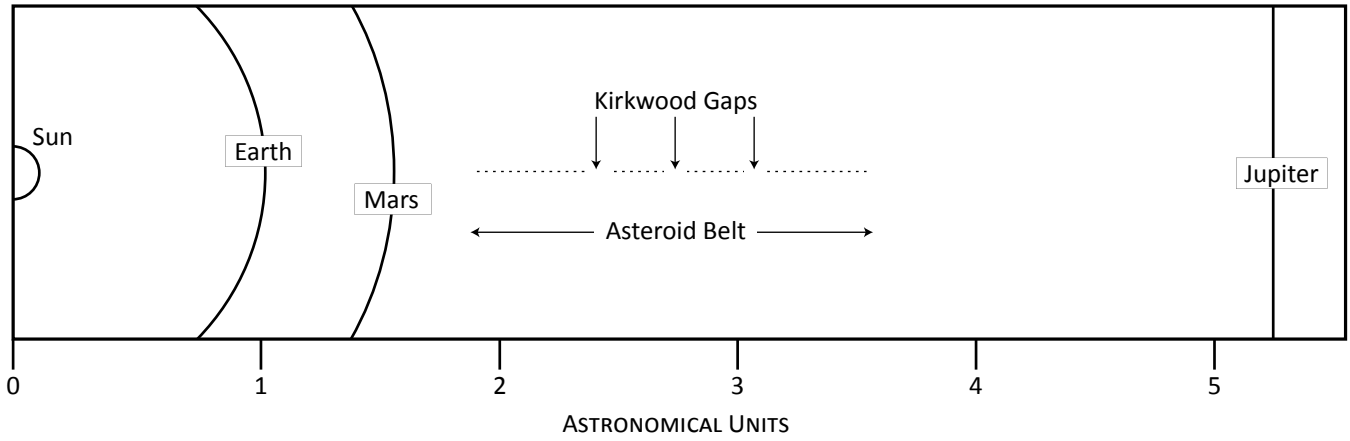

Figure 2. The asteroid belt is located between 2.1 and 3.3 astronomical units and is believed to contain over a million objects.[28] Oscillations in Jupiter's orbit (which created the Kirkwood Gaps) as well as collisions between the many asteroids are believed to eject objects from the belt, some with Earth-crossing orbits.[29]

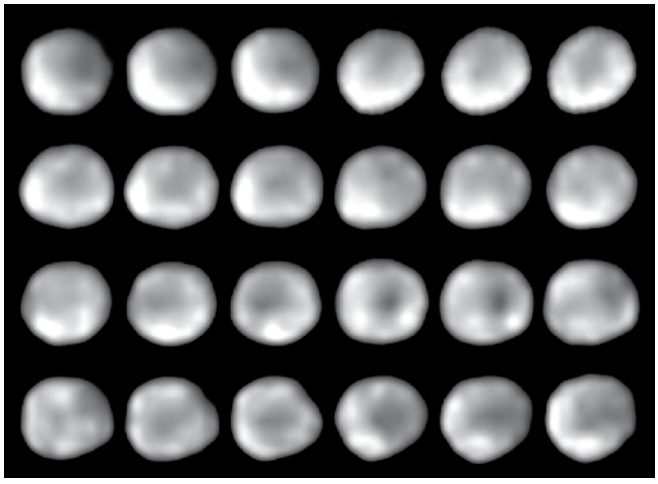

Figure 3. This collection of Hubble Space Telescope images from 1995 (viewed starting from the top, left to right and repeated to the bottom right) shows the entire surface of the rotating 4 Vesta asteroid. (Photograph courtesy of B. Zellner and NASA)

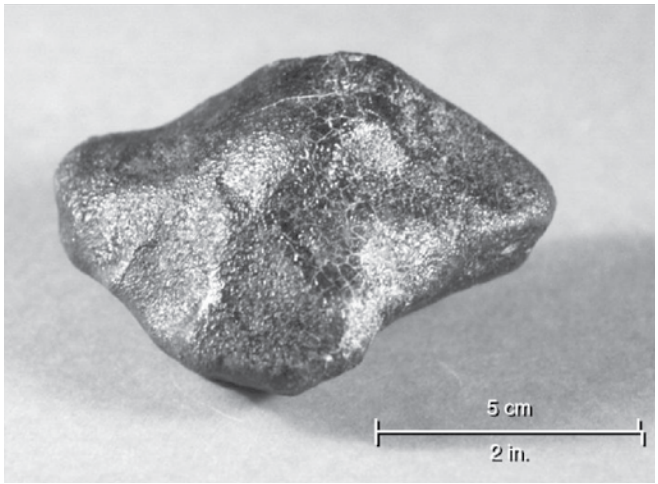

Figure 4. This meteorite is believed to have been derived from 4 Vesta. Photograph courtesy of R. Kempton, New England Meteoritical Services.

> "Removal of these Vesta-like bodies by orbital excitation of Jupiter and protoplanets rather than collisional grinding accounts for the absence of interior samples of the Vesta-like bodies and the preservation of Vesta's basalt-like surface. We suggest that the six anomalous eucrites largely escaped post-metamorphic shock and brecciation as they were sequestered in small asteroids during the Late Heavy Bombardment when the surface of Vesta was battered by impacts to produce the shock and brecciated features typical of most HED meteorites."[27]

The results of both investigations suggest that our present knowledge of these anomalous, achondritic meteorites is still limited and open to further interpretation. What should be noted is that no matter their composition—the source of these basaltic meteorites remains the asteroid belt.

Discussion and conclusions

The results of these studies indicate that achondritic asteroids unrelated to 4 Vesta reside in the innermost asteroid belt, and this region continues to deliver materials into Earth-crossing orbits.[26] It is not unreasonable to acknowledge that the asteroid belt generated objects that impacted Earth in the past and it continues to do so today.

The claim by naturalists that meteorites such as these "record the conditions that existed during the formation of the solar system"[24] is incorrect in the biblical framework of Earth history. The sun, moon, and stars (and asteroidal material) were created on Day 4. We cannot accept purported radiometric dates (even in a relative manner) designed to defend uniformitarianism at the expense of what the Bible teaches. While asteroids could have been ejected from the asteroid belt shortly after its creation, this is unlikely since everything that was created was proclaimed "very good"—implying perfection.

It is important to note that meteorites that strike Earth today are derived from fragments from individual asteroids as well as from materials ejected from the asteroid belt. This new discovery of anomalous basaltic meteorites derived from the innermost main asteroid belt adds support to the idea that this region was the source for the materials that impacted Earth with the advent of the Flood.

References

1. Whitcomb, J.C. and DeYoung, D.B., *The Moon: Its Creation, Form and Significance*, BMH Books, Winona Lake, IN, p. 97, 1978.
2. Unfred, D.W., Asteroidal impacts and the Flood-judgment, *Creation Research Society Quarterly* **21**:82–87, 1984.
3. Parks, W.S., The role of meteorites in a creation cosmology, *Creation Research Society Quarterly* **26**:144–146, 1990.
4. Auldaney, J., Asteroids and their connection to the Flood; in: *Proceedings of the 1992 Twin-Cities Creation Conference*, Twin-Cities Creation-Science Association, Northwestern College, Roseville, MN, pp. 133–136, 1992.
5. Fischer, J.M., A giant meteorite impact and rapid continental drift; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, Pittsburgh, PA, pp. 185–197, 1994.
6. Spencer, W.R., The origin and history of the solar system; in: Walsh, R.E. (Ed.), *Proceedings of the Third International Conference on Creationism*, Pittsburgh, PA, pp. 513–523, 1994.
7. Froede, C.R. Jr. and DeYoung, D.B., Impact events within the young-earth Flood model, *Creation Research Society Quarterly* **33**:23–34, 1996.
8. Froede, C.R. Jr. and Brelsford, J., Speculation regarding the albedo of the antediluvian moon, *Creation Research Society Quarterly* **35**:166–167, 1998.
9. Spencer, W.R., Catastrophic impact bombardment surrounding the Genesis Flood; in: Walsh, R.E. (Ed.), *Proceedings of the Fourth International Conference on Creationism*, Pittsburgh, PA, pp. 553–566, 1998.
10. Froede, C.R., Jr. and Williams, E.L., The Wetumpka Impact Crater, Elmore County, Alabama: An interpretation within the young-Earth Flood model, *Creation Research Society Quarterly* **36**:32–37, 1999.
11. Froede, C.R., Jr., Extraterrestrial bombardment of the inner solar system: A review with questions and comments based on new information, *Creation Research Society Quarterly* **38**:209–212, 2002.
12. Froede, C.R., Jr. and Hurt, J., An examination of the Odessa Meteor Craters (Ector County, Texas, U.S.A.) within the context of the young-Earth Flood framework, *Creation Research Society Quarterly* **40**:257–267, 2004.
13. Spencer, W.R. and Oard, M.J., The Chesapeake Bay impact and Noah's Flood, *Creation Research Society Quarterly* **41**:206–215, 2004.
14. Samec, R.G., Is the Moon's orbit 'ringing' from an asteroid collision event which triggered the Flood?; in: Snelling, A.A. (Ed.), *Proceedings of the Sixth International Conference on Creationism*, Creation Science Fellowship and Institute for Creation Research, Pittsburgh, PA, and Dallas, TX, pp. 255–261, 2008.
15. Samec, R.G., On the origin of lunar maria, *Journal of Creation* **22**(3):101–109, 2008.
16. Froede, C.R. Jr., On the origin of lunar maria, *Journal of Creation* **23**(3):49–50, 2009.
17. Oard, M.J., How many impact craters should there be on the earth? *Journal of Creation* **23**(3):61–69, 2009.
18. Oard, M.J. Venus impacts are not evidence against an astronomical trigger for the Flood, *Journal of Creation* **23**(3):98–102, 2009.
19. Bland, P.A., Spurny, P., Towner, M.C., Bevan, A.W.R., Singleton, A.T., Bottke, W.F. Jr., Greenwood, R.C., Chesley, S.R., Shrbeny, L., Borovička, J., Ceplecha, Z., McClafferty, T.P., Vaughn, D., Benedix, G.K., Deacon, G., Howard, K.T., Franchi, I.A. and Hough, R.M., An anomalous basaltic meteorite from the innermost main belt, *Science* **325**:1525–1527, 2009.
20. Scott, E.R.D., Greenwood, R.C., Franchi, I.A. and Sanders, I.S., Oxygen isotopic constraints on the origin and parent bodies of eucrite, diogenites, and howardites, *Geochimica et Cosmochimica Acta* **73**:5835–5853, 2009.
21. Binzel, R.P. and Shui, X., Chips off of Asteroid 4 Vesta: evidence for the parent body of basaltic achondrite meteorites, *Science* **260**:186–191, 1993.
22. NASA, Asteroid fact sheet, 2004; nssdc.gsfc.nasa.gov/planetary/factsheet/asteroidfact.html, accessed 11 February 2010.
23. Burbine, T.H., Buchanan, P.C., Binzel, R.P., Bus, S.J., Hiroi, T., Hinrichs, J.L., Meibom, A. and McCoy, T.J., Vesta, vestoids, and the howardite, eucrite, diogenite group: Relationships and the origin of spectral differences, *Meteoritics and Planetary Science* **36**:761–781, 2001.
24. Bland *et al*., ref. 19, pp. 1525.
25. Bland *et al*., ref. 19, pp. 1526.
26. Bland *et al*., ref. 21, pp. 1527.
27. Scott *et al.,* ref. 22, pp. 5850–5851.
28. McSween, H.Y. Jr., *Meteorites and their parent planets,* Cambridge University Press, New York, NY, 1999.
29. Modified from Dodd, R.T., *Thunderstones and Shooting Stars: The Meaning of Meteorites*, Harvard University Press, Cambridge, MA, figure 5.1, p. 55, 1986.

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