IV. Earth-Moon Comparative Planetology

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As the Solar System has traveled through our Galaxy, it has experienced different galactic environments: the regions north or south of the galactic plane, the central regions of the galactic plane, the spiral arms, various giant molecular clouds, star forming regions, open clusters, etc.

Since evidence is now accumulating to show that different planetary bodies in the Solar System respond (sometimes differently) to these various galactic environments, an examination of the historical experience recorded on (or in) these different bodies can tell us about the Galaxy. Perhaps most interesting are prospective cross-comparisons of the histories of different bodies, looking for indications of when they show certain changes or activity at the same time—indicating they could be responding to the same external influence.

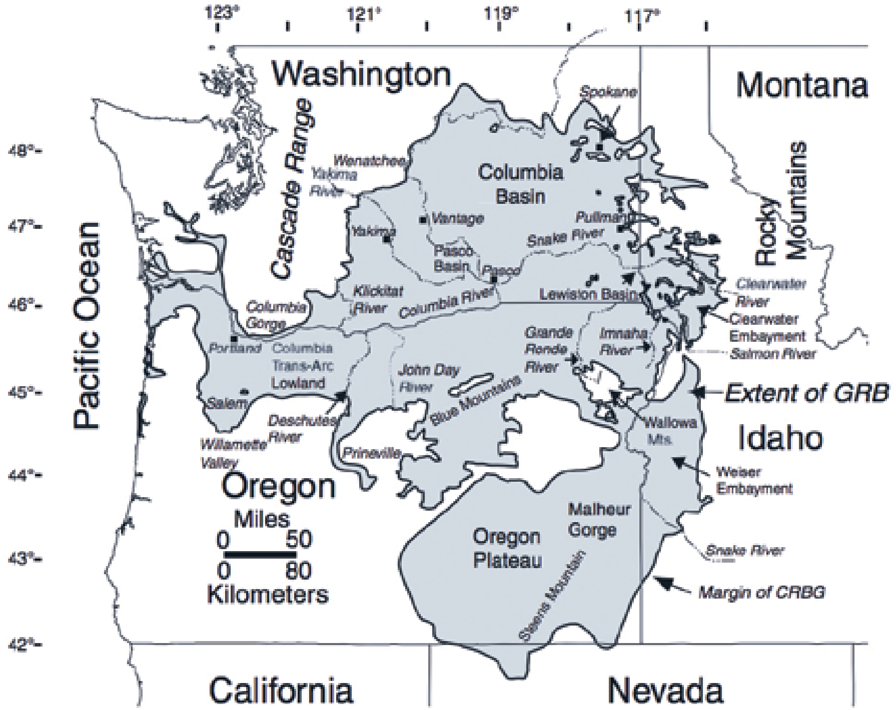


Image Credit:"Eruption chronology of the Columbia River Basalt Group," by T.L. Barry, et al. 2013 Geological Society of America.

This map shows the main regions of flood basalt exposure, resulting from massive lava flows starting sixteen and a half million years ago.

Cases of weather and climate changes on various planetary bodies were examined in the earlier article.[21] Another example is provided by a 2002 study by Nir Shaviv, "The spiral structure of the Milky Way, cosmic rays, and ice age epochs on Earth," which demonstrates a singleness of convergence from three different paths of investigation.

Path one: Shaviv examined existing models of the motion of our Solar System through the Galaxy, identifying when those models said the Solar System should be passing through the Galaxy's spiral arms.

Path two: Shaviv examined records of major global glaciation events in the Phanerozoic history of the Earth's climate, identifying their periods.

Path three: Shaviv examined iron meteorites, which—before falling to Earth—spent the past hundreds of millions of years orbiting the Sun in interplanetary space, experiencing the changing galactic cosmic radiation conditions of interplanetary space.

The three independent lines of investigation came together to indicate aspects of a single overall picture. On the one side, we have indications of when the whole Solar System may have experienced different galactic

21. "Solar System Weather Changes Challenge Conventional Theories," by Meghan Rouillard, in Part III in this report.

Peter Hartree (Attribution-ShareAlike 2.0 Generic)

The eruption of the Baroarbunga Volcano on September 4th 2014.

environments, and, on the other side, we have records of different bodies of the Solar System responding in their own way to changing cosmic environmental conditions (for the Earth, a response of the climate system; for the asteroid pieces which are to become meteorites, a response in the records of chemical transmutation—through galactic cosmic ray spallation—and the subsequent records told by the radioactive decay of the created elements).

For the response of Earth systems, additional examples (besides climate response) include the potential reaction of life and the biosphere to these varying galactic environments.[22]

Here we will briefly focus on provocative evidence indicating that perhaps records of another type of planetary activity might also be telling us about different galactic environments: the processes underlying large-scale planetary volcanic events and geophysical activity more generally.

While such a relation—showing planetary geophysical activity to be responsive to galactic influences—would be extremely challenging to the current paradigm of stellar-level science, this is not the first time the question has been posed. Here, in addition to identifying existing investigations, we will add another bit of evidence, which, to this author's knowledge, hasn't been posed before: the temporal correspondence between the largest three recent periods of lunar volcanism with the last three major periods of flood basalt events on Earth.[23]

Since the geophysical (or comparable) activity within planetary bodies is currently believed to be an isolated and self-determined product of that planetary body, indications for responses to external influences could point to mechanisms associated with a new galactic-level of science.

Biodiversity, Geophysical, and Galactic Cycles

In 2005 a ~60 million year cycle in marine fossil biodiversity was discovered.[24]

Subsequent investigations into the possible cause of this cycle noted that the period and phase of the cycle correspond very well with the modeled motion of our Solar System above and below the plane of our Galactic System.[25] However, a galactic influence guiding the evolution of life has remained outside the scope of thought of most researchers, because it would require the relation (mechanism) to be expressed though a north-south dissymmetrical characteristic in the Galactic System.[26]

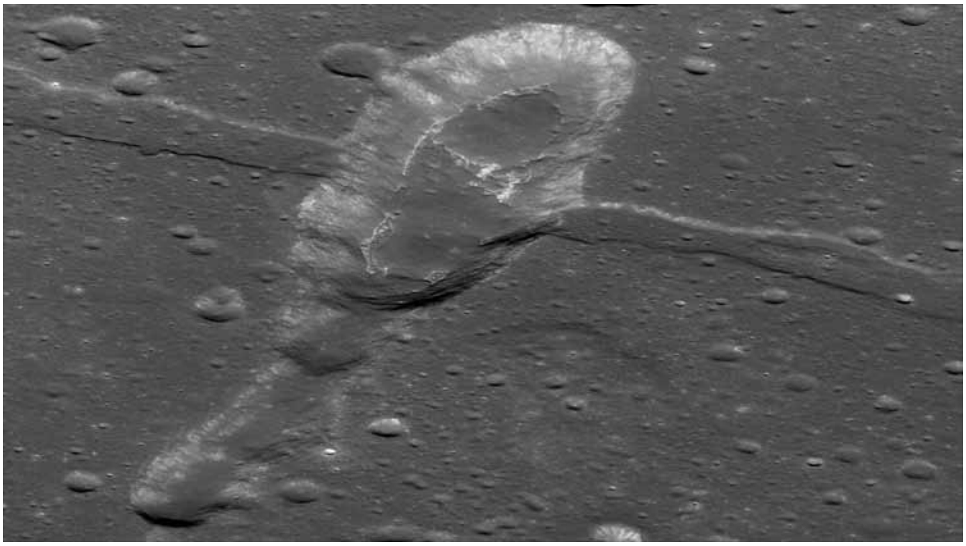
22. See "A Vernadskian Reconsideration of Galactic Cycles and Evolution" in this report.

23. Flood basalt events are produced when a massive volcanic eruption or a series of eruptions cover large areas with lava. These can also produce structures called large igneous provinces.

24. "Cycles in fossil diversity," Rohde, Muller; 2005.

25. "Do extragalactic cosmic rays induce cycles in fossil diversity?" Medvedev and Melott, 2007.

26. "A Vernadskian Reconsideration of Galactic Cycles and Evolution," Benjamin Deniston; *EIR*, May 22, 2015.



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The Sosigenes lava flow (irregular mare patch) might be just 18 million years old.

At around the same time other studies showed that cycles in geophysical activity (large scale volcanism, sedimentation, and continental uplift) match this ~60 million year biodiversity cycle quite well.[27]

Could the biodiversity cycles and the geophysical cycles both be expressing a response to the changing galactic environment experienced by the Solar System?

There are two ways this question can be approached.

One approach—which could be called the 1900 approach[28]—states that a mechanism must first be posited to explain how the interaction could occur within the framework of currently known (or possibly accepted) physics, and only then can the question be asked. At least one published study (known to this author) has attempted to related biodiversity cycles, geophysical activity, and the motion of our Solar System through the Galaxy in this way; however their mechanism is unable to account for all the correlations between galactic travels and geophysical activity on Earth.[29]

Another approach—what could be called a Cusian approach[30]—examines such correlations between activity of the lower order system associated with its changing relations to the higher-order system as clues and anomalies which might force the need for a new level of science—a new understanding associated with a higher-order galactic principle (and a corresponding higher-order physics, subsuming present notions).

Corresponding independent responses from different planetary bodies in our Solar System (the Earth and Moon) provide an impetus to force more attention to this second approach.

A Cusian Approach

In late 2014 a study was published showing that the Moon has been volcanically active much more recently than scientists had thought.[31]

While it was thought that volcanism on the Moon ended around a billion years ago, this study showed that multiple lunar volcanic structures are almost certainly less than 100 million years old. The study provided approximate dates for the three largest of these recent structures.

•"Sosigenes irregular mare patch" (IMP), covering 4.5 km^2, is dated to about 18 million years (Myr) ago (+/- 1 Myr)

•"Ina," covering 1.7 km^2, is dated to about 33 Myr (+/- 2 Myr)

•"Cauchy-5 IMP," covering 1.3 km^2, is dated to about 58 Myr (+/- 4 Myr)

In pursuit of a Cusian approach, this author thought to compare these three dates with periods of increased volcanic activity on Earth.

Two sources provide the approximate dates for periods of increased large-scale Earth volcanism (referred

27. "Sixty-two million year cycle in biodiversity and associated geological processes," Rohde, 2006. "60-Myr Periodicity Is Common to Marine Sr, Fossil Biodiversity, and Large-Scale Sedimentation: What Does the Periodicity Reflect?" Melott, Bambach, Petersen, McArthur, 2012.

28. See Jason Ross's presentation to the May 16, 2015 Schiller Institute New York City conference, and "The Escape from Hilbert's 'ZETA' 'X': Mapping the Cosmos!" by Lyndon LaRouche, *EIR*, March 19, 2010.

29. "Disc dark matter in the Galaxy and potential cycles of extraterrestrial impacts, mass extinctions and geological events," Rampino, 2015.

30. *De Docta Ignorantia*, Nicholas of Cusa, 1440.

31. "Evidence for basaltic volcanism on the Moon within the past 100 million years," Braden, Stopar, Robinson, Lawrence, vander Bogert, Hiesinger, 2014.

to as "flood basalt events" or the creation of "large igneous provinces").[32]

As can be seen in the accompanying table, the correspondence with the recent lunar volcanic events is remarkable.

Earth Flood Basalt Events		Recent Lunar Volcanism	
Columbia River Flood Basalts	15.3-16.6 Myr	Sosigenes IMP	18 (+/- 1) Myr
Ethiopian and Yemen traps	29.5-31 Myr	Ina	33 (+/- 2) Myr
North Atlantic Tertiary Volc. Prov. 2	54-57 Myr	Cauchy-5 IMP	58 (+/- 4) Myr

It is generally assumed that volcanic activity is a product of the internal dynamics of a planetary body acting in isolation from the rest of the Solar System and Galaxy.

Yet here we see evidence of two different bodies coming into activity simultaneously—a temporal correspondence in the three largest recent volcanic events on the Moon, and the three most recent flood basalt events on the Earth—as if both bodies (Earth and Moon) were responding to the same environmental influence. This evidence for coordinated interplanetary activity provides potential support for examining the earlier-mentioned longer-term correlation between cycles in other forms of geophysical activity, and the motion of our Solar System through the Galaxy.

Because we only have three events (and room for improvement in the dating of the lunar events), this points to the importance of developing much more detailed investigations of these and other structures on the Moon (as well as on other bodies, such as Mars, various asteroids, other planets, other moons, etc.), enabling a more thorough comparison of the histories of various components of our Solar System in search of indications of a coordinated response to the higher-order Galactic System.[33] This will be critical to further pursuing this path of investigation of the nature of Galactic System, as expressed in the subsumed activity of the Solar System, and its various components.

32. "On the ages of flood basalt events," Vincent E. Courtillot, Paul R. Renne; 2003. "Time-Series Analysis of Large Igneous Provinces: 3500 Ma to Present" Prokoph, Ernst, Buchan, 2004.

33. Another provocative study, examining a much shorter time scale, showed that moonquakes (measured from 1969 to 1977) preferentially occurred when the Moon was facing a specific sidereal position, prompting the author to ask about a "Possible Extra-Solary-System Cause For Certain Lunar Seismic Events" (Yosio Nakamura and Cliff Frohlich, 2006).

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