Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PPS03-P03 Room:Convention Hall Time:May 20 18:15-19:30

Planetary Tectonic System (#2): Classification for the Search of Life Beyond Earth

James Dohm[1*], Shigenori Maruyama[1]

[1]Earth-Life Science Institute, Tokyo Institute of Technology

For life to initiate, diversify, and flourish, it requires a continuous nutrient supply, metabolism with continuous reactions to gain energy, and self-duplication [1; also see Shigenori Maruyama, this conference]. Based on our understanding of the evolution of Earth, which includes the Cambrian explosion [1; also see Shigenori Maruyama, this conference], these conditions can be optimally met through a planetary tectonic system (PTS) that is composed of a nutrient-enriched continental landmass, an ocean, tectonic structures such as rift systems that act as conduits for the migration of volatiles and heat energy, as well as the delivery of toxic elements (e.g., radiogenic nuclides) for the diversification of life (evolution requires perturbations from normal conditions), and a sunlit planetary surface [1].

Since a PTS provides the road map for the search for life beyond Earth [also see, Maruyama and Dohm, this conference], we propose a classification of planetary bodies with certain PTSs unfolded through geological investigation using existing planetary data sets.

Such a classification is not only based on the distance of the planetary body from the Sun and its composition, but also by its characteristic PTS. This is important, because the birth place of life and evolution is controlled by an optimal PTS as exemplified during the Cambrian explosion [1; also see Maruyama and Dohm this conference]. Without understanding PTS, it is impossible to target possible candidates of life-sustaining habitable environments both in and outside our solar system.

The types of PTS are: (1) Earth-Cambrian-explosion [1; also see Maruyama, this conference], (2) Ice-house Mars [2,3], (3) Hot-house Venus [3,4], (4) Rigid Mercury, (5) Gaseous-giants, and (6) Frigid, dynamic, and/or hydrologically exotic satellites. Others types (e.g., Kuiper belt planets and dwarf-planets) could be added in the future.

Detailed characteristics of the various PTSs will be detailed at the conference.

References

[1] Maruyma, S et al., (2013?in press), Geoscience Frontiers 171.

[2] Dohm, J.M., et al. (2011) GSA Special Paper 483, 317?347, doi:10.1130/2011.2483(21).

[3] Baker, V.R. et al. (2007) In Superplumes: beyond plate tectonics. D.A Yuen, S. Maruyama, S-I Karato, and B.F. Windley (eds.). Springer, pgs. 507-523.

[4] Schulze-Makuch, D., et al. (2005) Astrobiology 5, 778-795.