

# ELSI 4<sup>th</sup> international symposium

## “Three experiments in biological origins: early Earth, Venus and Mars”

### - Program of oral presentations-

Introductory day (Tue 12th)	
14:00 - 14:15	<b>Kei Hirose, George Helffrich (ELSI, Japan)</b> Welcome and Introduction
14:15 - 15:00	<b>Shigeru Ida (ELSI, Japan)</b> Introduction to day 1 topics: Planet formation and volatile delivery to terrestrial planets
15:00 - 15:45	<b>Dave Stevenson (Caltech, USA)</b> Introduction to day 2 topics: The Nature of Planets
15:45 - 16:30	<b>Norm Sleep (Stanford, USA)</b> Introduction to day 3 topics: Disequilibria and the requirements for (successful) pre-biotic chemistry
16:30 - 16:35	Instructions to poster presenters
16:35 - 18:30	<i>Coffee and poster viewing</i>
19:00 – 20:30	Public lecture: “Does water define a planet's habitability?” <b>Victoria Meadows (University of Washington/NASA Astrobiology Institute)</b> <b>Tomohiro Usui (Tokyo Tech)</b>
Day 1 (Wed 13th) - The Formation of Venus, Earth and Mars	
09:00 - 09:40	<b>Colette Salyk (Vassar College, USA)</b> Chemistry in terrestrial planet forming regions of protoplanetary disks
09:40 - 10:20	<b>Hal Levison (SwRI, USA)</b> The Formation of Terrestrial Planets from the Direct Accretion of Pebbles
10:20 - 10:50	<i>Coffee</i>
10:50 - 11:30	<b>Francis Albarede (ENS Lyon, France)</b> Volatility scale, gravitational escape, and abundance of water and volatiles in the Moon and Earth
11:30 - 12:00	<b>Q&amp;A and discussion</b> Discussion leaders: Shigeru Ida
12:00 - 13:30	<i>Lunch</i>
13:30 - 14:10	<b>Bernard Marty (CRPG Nancy, France)</b> Origins and timing of volatile elements on Earth and Mars in view of the results of the Rosetta mission
14:10 - 14:50	<b>Hidenori Genda (ELSI, Japan)</b> Giant impacts and early evolution of terrestrial planets
14:50 - 15:20	<i>Coffee</i>
15:20 - 16:00	<b>Kosuke Kurosawa (Chiba Tech, Japan)</b> An atmospheric response against from impact bombardments on Earth and Venus: The role of impact ejecta
16:00 - 16:40	<b>Patrick McGovern (LPI, USA)</b> The Martian Crustal Dichotomy: an Ancient and Fundamental Feature
16:40 - 17:10	<b>Q&amp;A and discussion</b> Discussion leaders: Steve Mojzsis
17:10 - 18:30	<i>Poster viewing</i>

## Day 2 (Thu 14th) - Planets as Integrated Systems

09:00 - 09:40	<b>Victoria Meadows (U Washington, USA)</b> Exoplanets: A New Era of Comparative Planetology
09:40 - 10:20	<b>Yuk Yung (Caltech, USA)</b> Chemistry of the Atmospheres of Planets and Exoplanets
10:20 - 10:50	<i>Coffee</i>
10:50 - 11:30	<b>Caroline Dorn (U Bern, Switzerland)</b> Interiors of low-mass exoplanets: what can we learn from observations?
11:30 - 12:00	<b>Q&amp;A and discussion</b> Discussion leaders: Dave Stevenson
12:00 - 13:30	<i>Lunch</i>
13:30 - 14:10	<b>Michael Way (NASA Goddard, USA)</b> Was Venus the first habitable world of our solar system?
14:10 - 14:50	<b>Axel Kleidon (MPI Jena, Germany)</b> What can thermodynamics tell us about the functioning of the Earth system, its habitability, and its evolution?
14:50 - 15:20	<i>Coffee</i>
15:20 - 16:00	<b>Roger Buick (U Washington, USA)</b> Evolution of Earth's biogeochemical nitrogen cycle: an example of an integrated system influencing planetary habitability
16:00 - 17:15	<b>Q&amp;A and discussion</b>
17:15 - 18:30	<i>Poster viewing</i>

## FROM 19:00 — SYMPOSIUM BANQUET HELD IN ELSI-1 BUILDING, 2<sup>ND</sup> FLOOR

## Day 3 (Fri 15th) - Starting Conditions and Requirements for Prebiotic Chemistry

09:00 - 09:40	<b>Steve Vance (JPL, USA)</b> Atmosphere disequilibrium in different planetary contexts
09:40 - 10:20	<b>Yuichiro Ueno (ELSI, Japan)</b> Disequilibrium of prebiotic atmosphere: C-H-O systems and role of water
10:20 - 10:50	<i>Coffee</i>
10:50 - 11:30	<b>Everett Shock (ASU, USA)</b> Geologic Sources of Chemical Disequilibria on Terrestrial Planets
11:30 - 12:00	<b>Q&amp;A and discussion</b> Discussion leaders: Jim Cleaves
12:00 - 13:30	<i>Lunch</i>
13:30 - 14:10	<b>Wolfgang Nitschke (IMM/BIP, France)</b> From thermodynamic disequilibria in alkaline hydrothermal vents to dissipative structures giving birth to life
14:10 - 14:50	<b>Joseph L. Kirschvink (Caltech-JPL/ELSI, Japan)</b> Are we really from Tharsis? An analysis of the electrochemical environment of early Martian high-altitude glaciers during late Noachian time
14:50 - 15:20	<i>Coffee</i>
15:20 - 18:00	<b>Wrapup discussion "Why?"</b> Discussion leaders: Eric Smith & Steve Mojzsis

## - Program of poster presentation -

Session A - Planetary structure and evolution	
A-1	<b>High-Resolution Global N-body Simulation of Planetary Formation: Outward Migration of a Protoplanet</b> Junko Kominami
A-2	<b>Dynamical mixing of the Earth's core by a giant impact</b> Miki Nakajima
A-3	<b>Early inner core formation in terrestrial planets</b> George Helffrich
A-4	<b>Crystallization of SiO<sub>2</sub> in Earth's core: The new core paradox on early geodynamo and its solution</b> Kei Hirose
A-5	<b>Critical Review: Is Earth's Outer Core Liquid or a High Density Plasma?</b> Daniel Helman
A-6	<b>Liquid Iron Alloys with Hydrogen at Outer Core Conditions by First Principles</b> Koichiro Umemoto
A-7	<b>Discovery of new iron oxide Fe<sub>7</sub>O<sub>9</sub> and its solid solution, (Mg,Fe<sup>2+</sup>)<sub>3</sub>Fe<sub>3</sub>+4O<sub>9</sub></b> Ryosuke Shinmyo
A-8	<b>Core-mantle equilibrium temperature of the Earth</b> Hiroki Ichikawa
A-9	<b>Direct sound velocity measurements of pyrolite across the mantle transition region</b> Steeve Greaux
A-10	<b>The rheological structure and formation of plate boundaries on early Mars</b> Shintaro Azuma
A-11	<b>Geodynamically driven temporal &amp; local formation of hydrogen and complex hydrocarbons</b> Vlada Stamenković
A-12	<b>Water, melt, and surface-interior connections: Implications for Venusian tectonics</b> Vlada Stamenković
A-13	<b>Influence of temperature-dependent tidal dissipation on lunar crust formation</b> Matthieu Laneuville
A-14	<b>True continental growth curve and fate of the continental crust</b> Hikaru Sawada
Session B - Early environments and habitability	
B-1	<b>Constraints on early Mars atmospheric pressure inferred from nitrogen and argon isotopes</b> Hiroyuki Kurokawa
B-2	<b>Possibility of aerobic environments on early Mars</b> Lewis Ward
B-4	<b>Pulling back the veil: The habitability and characterization of hazy worlds</b> Giada Nicole Arney

B-5	<b>In-situ iron isotope analysis of pyrite and organic carbon/nitrogen isotope ratios from the Middle Proterozoic sediments, McArthur Basin, Northern Australia</b> Kazumi Yoshiya
<b>Session C - Prebiotic chemistry</b>	
C-1	<b>Quantifying impactor delivery of amino acids during the timespan relevant to emergence of life</b> Elizabeth Bailey
C-2	<b>Mineral and Organic Compound Interactions at the Emergence of Life: Magnetite's Effect on Carboxylic Acids</b> Kristin Nicole Johnson
C-3	<b>Abiogenic synthesis of hydrocarbons revealed by position-specific isotope analysis</b> Alexis Gilbert
C-4	<b>Electrochemically-driven carbon fixation</b> Norio Kitadai
C-5	<b>Abiotic ammonia synthesis using Mo-bearing sulfide minerals</b> Yamei Li
<b>Session D - Origins of life</b>	
D-1	<b>Signature of Life in isotopic distributions of C, H, N and O</b> Roman Zubarev
D-2	<b>Restoration of an ancestral form of the reductive TCA cycle as a primitive carbon fixation pathway</b> Masafumi Kameya
D-3	<b>Virus exploration in extreme environments provides insights for the RNA world theory, and possible alternative genotypes — the first hyperthermophilic single stranded DNA virus —</b> Tomohiro Mochizuki