

Summary of AbSciCon (Astrobiology Science Conference) 2019



- AbSciCon 2019 Theme: **Understanding and Enabling the Search for Life on Worlds Near and Far**
- Event Details:
 - Event Location: **Bellevue, WA**
 - Approximate # of attendees: **900 (>3x larger than 2 years ago)**
 - Attendee Demographics: **Academia / Researchers / NASA**

AbSciCon 2019 Topics



- Star-planet-planetary system interactions and habitability
- Alternative and agnostic biosignatures
- Understanding the environments of early Earth
- Evidence for early life on Earth
- Subsurface habitability and life
- Ocean worlds near and far
- Characterizing habitable zone exoplanets
- Transition of prebiotic chemistry to biology
- Energy sources in the environment and metabolic pathways that use that energy
- Terrestrial planets orbiting M dwarfs

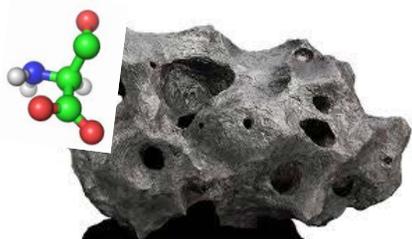
Nature May Present Challenges to Higher-order Life Forms



Artist's conception of Earth-sized planet discovered orbiting Proxima Centauri

- **Earth has special conditions** that may skew our view of how common higher-order life is
 - We have learned that Ocean Worlds are more common than had been thought
 - Ocean Worlds with frozen crusts are blocked from solar energy, depend on chemical energy from rocks, may limit the biosphere
 - Ocean Worlds with a deep ocean will have a bottom layer of “ice-VI” that might block water from rock, starving nutrients / chemical energy.
 - Most Ocean Worlds likely occur around M-dwarf stars like Proxima Centauri. They flare early and push planets in the “habitable zone” through an early Venus phase. Sun-like G-type stars are much more stable.
 - Planets orbiting their stars can have large variations in obliquity causing extreme climate change on liquid surfaces. Earth’s very large Moon damps these changes.

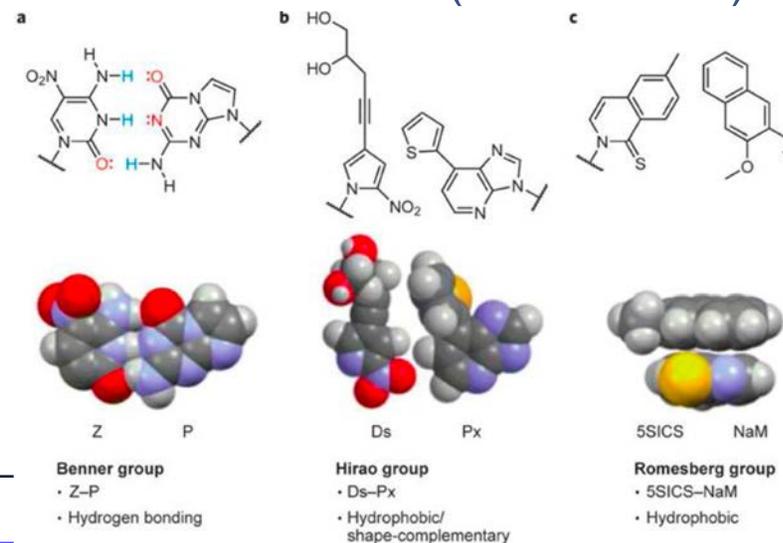
“Alive or Not?” and Agnostic Biosignatures



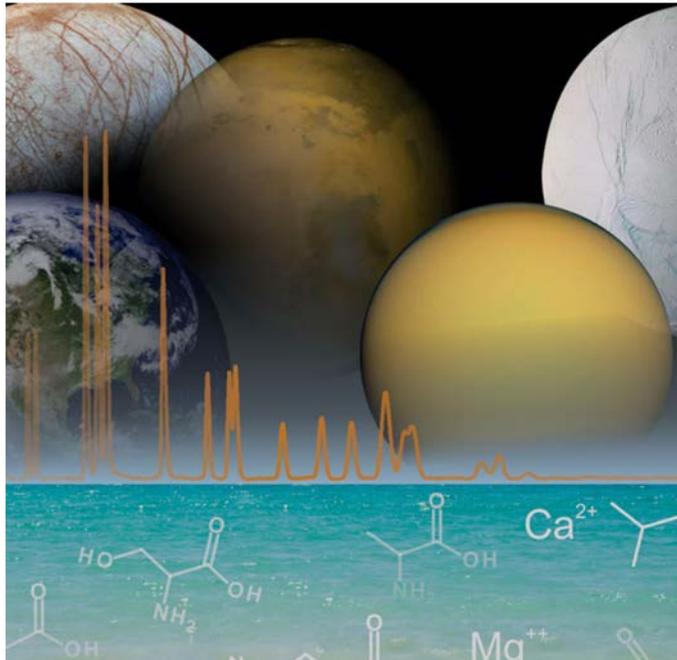
Meteorite, Canyon Diablo

- Fully analyzing all our available meteorite samples analog samples, etc. for Amino Acids, and **gathering *all* results** from previous studies
- Important in order to get in depth “big data” of life as we know it, for establishing life detection metrics (A. Stockton)

- Base pairs unlike our own, alternative genetic alphabet (A. Ellington)
- Molecular and spectroscopy complexity as a biosignature (L. Zeng, S. Johnson)



Many Biosignature Detection Technologies are on the Rise



- Example Technologies

- “Nanomotion” of cells with atomic force microscopy (L. Venturelli)
- Chiral amino acid detection via fluorescence (Jessica Creamer)
- Pigments (Christine Foreman)
- Raman spectroscopy (Svetlana Shkolyar)
- Subcritical water/ CO_2 extractor (Florian Kehl)
- Portable cell counter via DNA fluorescence tagging (Nicholas Speller)

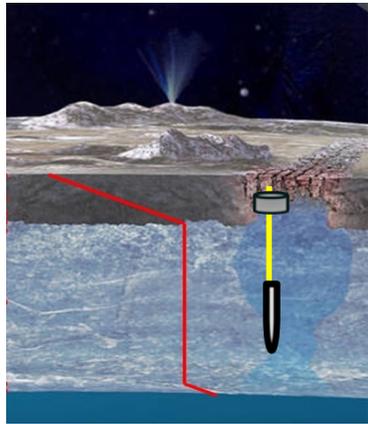
The impact of salt on instrumentation for astrobiology



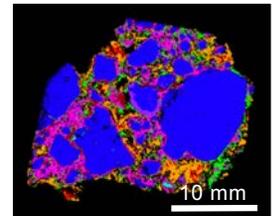
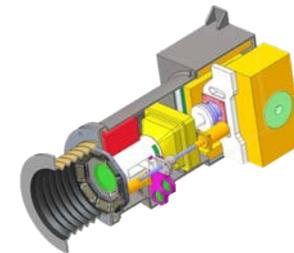
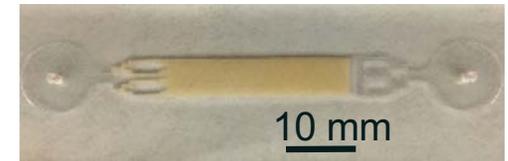
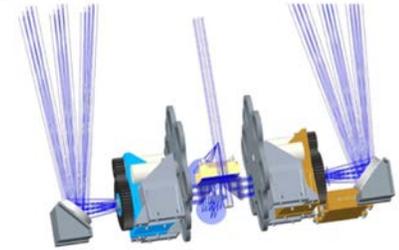
- Salt interferes with the signal from many preparation and identification based analytical platforms
- investigations into new customized instrumentation
 - Lyophilization and NMR Spectroscopy (Bruce E. Hammer)
 - Capillary Electrophoresis (Amanda Stockton)
 - Cell Identification and Sorting (Zoe Harrold)
- Salty Goodness session – Habitability within brines



Missions and Tech in Development



- Dragonfly / the science of Titan
- Europa Lander Stereo Spectral Imaging Experiment (ELSSIE)
- Sample purification chip
- Ocean world access technologies
- Advanced Multispectral Infrared Microimager (AMIM)



Workshops – Instrumentation for in situ Exploration of Europa and Ocean Worlds



- Standing room Only! Same for Life Detection forum

Upshot – Large part of Astrobiology Community is interested in figuring out how to achieve life detection at these Ocean Worlds



NASA Astrobiology Program Evolving to Meet Future Challenges



New Model: Astrobiology “Research Coordination Networks” (RCNs)

- Network for Ocean Worlds (NOW)
- The Nexus for Exoplanet System Science (NExSS)
- Prebiotic Chemistry and Early Earth Environments Consortium (PCE3)
- Network for Life Detection (NFoLD)
- From Early Cells to Multicellularity (Starting in late 2019)
- These new RCNs will play important roles in guiding and coordinating future astrobiology investigations.



Dragonfly selected for flight!



Dragonfly team members field questions after announcement of selection for flight

AbSciCon 2019



- Astrobiology is a growing field and cross-cuts many NASA missions (ex. Mars 2020, Europa Clipper, Dragonfly)
- Exploration of Ocean Worlds and exoplanets are ascending fields
- This meeting saw greater participation from Earth's ocean community
- Lots of great technologies being developed that are enabling to studies and missions
- Ocean Worlds and exoplanets are central to future space exploration, seeking signals of life

Ocean Worlds IV



MAY 21-22, 2015

COLUMBIA, MARYLAND

- Focus on the **ice-water interactions** occurring within ocean worlds beyond Earth, from a multi-disciplinary and inter-disciplinary perspective.
- Primary motivation is to engender a cross-fertilization of ideas and expertise by soliciting contributions from both the **Ocean Sciences and Planetary Sciences communities**.
- Topics included aspects of the broad ice-water interaction theme across the Planetary and Ocean Science fields: including **geophysics**, **hydrogeology**, **geochemistry**, and **microbiology**.

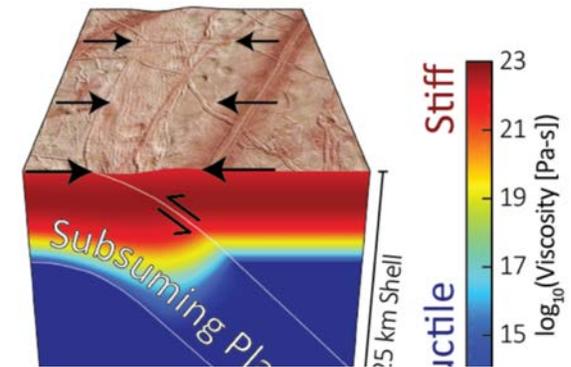
Ocean Worlds IV



MAY 21-22, 2019

COLUMBIA, MARYLAND

- **Modeling of Ice Shells**
 - Convection and Rifting (L. Montessi)
 - Icy Slabs and Active Convergent Margins (S. Howell)
 - Ice Shell Evolution (J. Roberts)
- **Water in Ice: Modeling, Field, and Lab Work**
 - Complex Viscosity Structure of Icy Shells (A. Rhoden)
 - Brine Drainage from Chaotic Terrains (M. Hesse)
 - Impurity Entrainment at Ice-Liquid interface (J. Buffo)
- **Water in Ice: Mission Proposals and Field Work**
 - Polar windows to Ocean Worlds (A. Murray)
 - Ocean Glacier interactions (B. Schmidt)
 - Technology and Field Studies (C. German, SESAMEs)



Interdisciplinary meetings - IMPORTANT

- Ocean Sciences and Planetary Sciences communities
- Astrobiology includes many disciplines to understand life, where it can exist and how to detect it!



**Ocean
Sciences
Meeting 2020**

16-21 February 2020 in San Diego, Calif.