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# Mars Extant Life: What's Next?

- Extant life is a component of the MEPAG Goals document that has received very little attention over the last two decades, but for which new scientific concepts and understandings could lead to effective strategies and mission concepts.
  - Keys are: Where to go?, and What to measure?
- Conference venue: the National Karst and Cave Research Institute in Carlsbad, NM, November 5<sup>th</sup>-8<sup>th</sup>, 2019
- Number of attendees: 71 (including from US, Mexico, Germany, France)
- Number of abstracts: 83 (including 16 print-only)
- Featured field trip to Carlsbad Caverns, DoE Waste Isolation Pilot Plant (WIPP), Chosa Draw cave, and Dark Canyon surface outcrops

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1. A substantial subset of the Mars community is actively interested in continuing the search for extant life on Mars
  - Recent advances, including improved knowledge of Mars' geologic diversity and history, terrestrial life in extreme environments, and measurement methods, would improve our search strategies.
2. There was consensus that the following four candidate geologic environments are the best in which to look:

Deep  
subsurface

Caves

Salts

Ice

*(NOT  
PRIORITIZED)*

- The conference group was not able to reach a consensus prioritization of the above options—there are multiple considerations. Getting these prioritized may best be done by a future competition.
- There are significant differences regarding perceptions of discovery potential, and the difficulty of carrying out a yes/no test.



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3. Strategies can be identified to narrow the search space for extant life using various aspects of geology, chemistry, and geomorphology at different scales
  - IF biosignatures can be found in relatively young rocks (even up to 100My old) this would be taken as evidence that extant life still exists (somewhere) on Mars
4. Methods for detecting extant life vary depending on the assumptions
  - For Earth-like life: looking for biomolecules, detailed organic analyses through spectroscopy, structures (morphology, membranes) w/ microscopy, and metabolism
  - Agnostic life detection: patterns of complexity (structural, molecular, isotopic, elemental, geochemical); complex organic chemistry, biology
  - Far more detailed life assays are possible via MSR