UV-absorbance and survival mechanism of potential bacteria in Venus clouds

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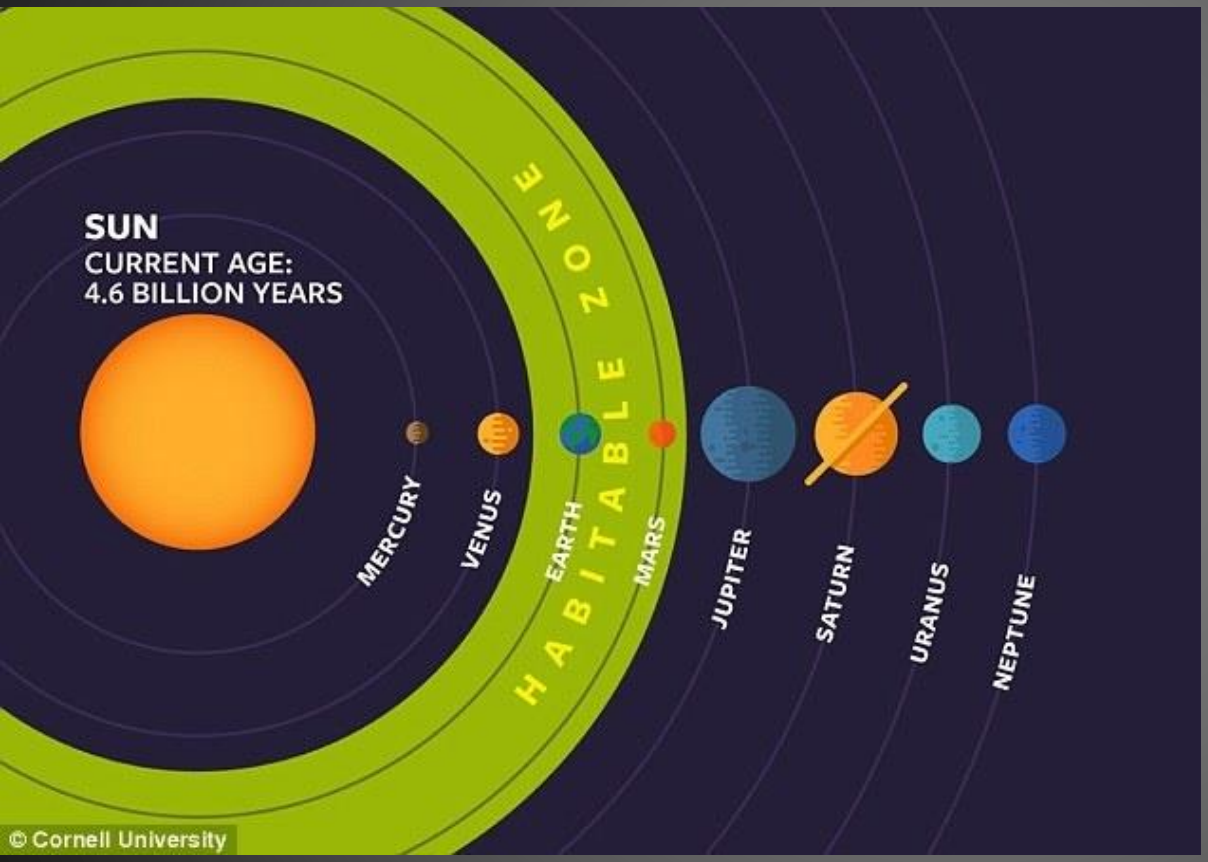
Life

- Organic molecules that can interact with environment and has replicating ability.
- Basic requirement for life: presence of C and liquid H_2O.
- Ideal temperature; normally between freezing and boiling temperature.
- However even above the boiling point H_2O could be in liquid form e.g. deep sea hydrothermal vents, at 407°C and 29.8 MPa (Koschinsky et al., 2008; McDermott et al., 2018).

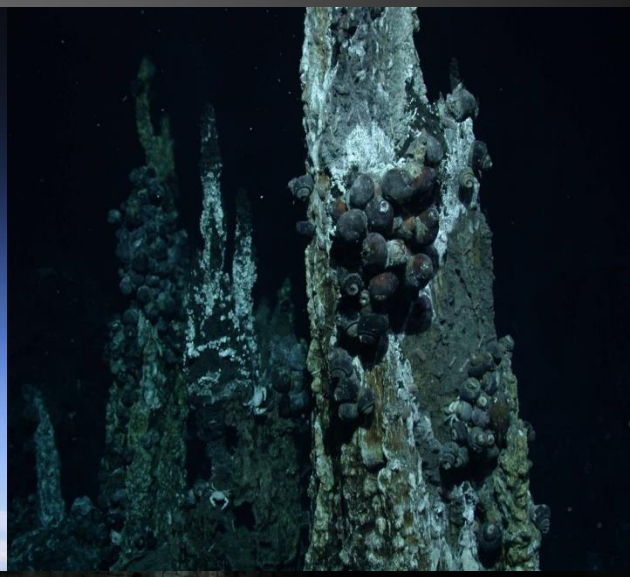
Habitability



- It is a relative and species specific term.
- The traditional definition “habitable zone” is determined by the planet’s distance from a star.

- Our view of the boundaries of the microbial habitability is widening.

- Viable life from Stratosphere (up to 50 km above earth surface) to deep in the ocean (Merino et al., 2019) and in continental mines at a depth of 2.4 Km (Kidd Creek Mine Canada; Lollar et al., 2019).



Examples of Extreme Biomes

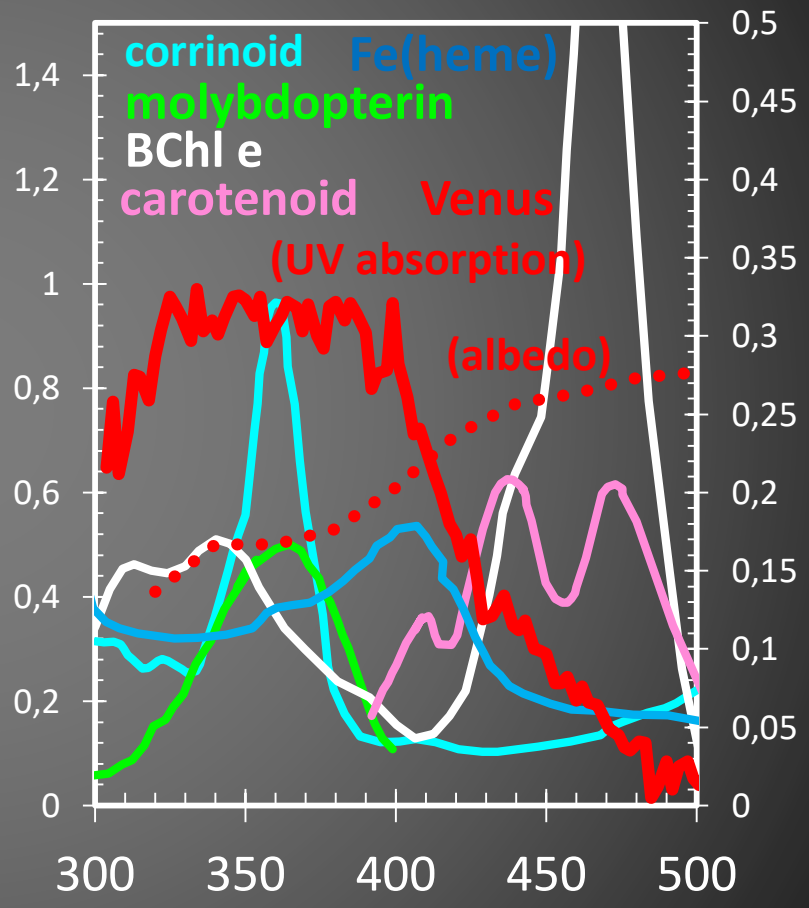
Biome	Temperature (°C)	pH	Pressure (MPa)	Salinity (% NaCl)
Terrestrial hot-spring	16-270	0.02-9.8	0.1-7.2	0.0002-Saturation
Deep sea hydrothermal vent	1-464	4-11	2.1-50.7	0.1-8
Deep sea floor trenches	-1.9-13.8	7.3-8.1	2.1-12	3.4-3.9
Subsurface ecosystems	3.25-400	1-12.8	< 800	0.6-Saturation
Mine drainage	1-47	-3.6-13.3	6-14	0.008-7.6

Merino et al. (2019)

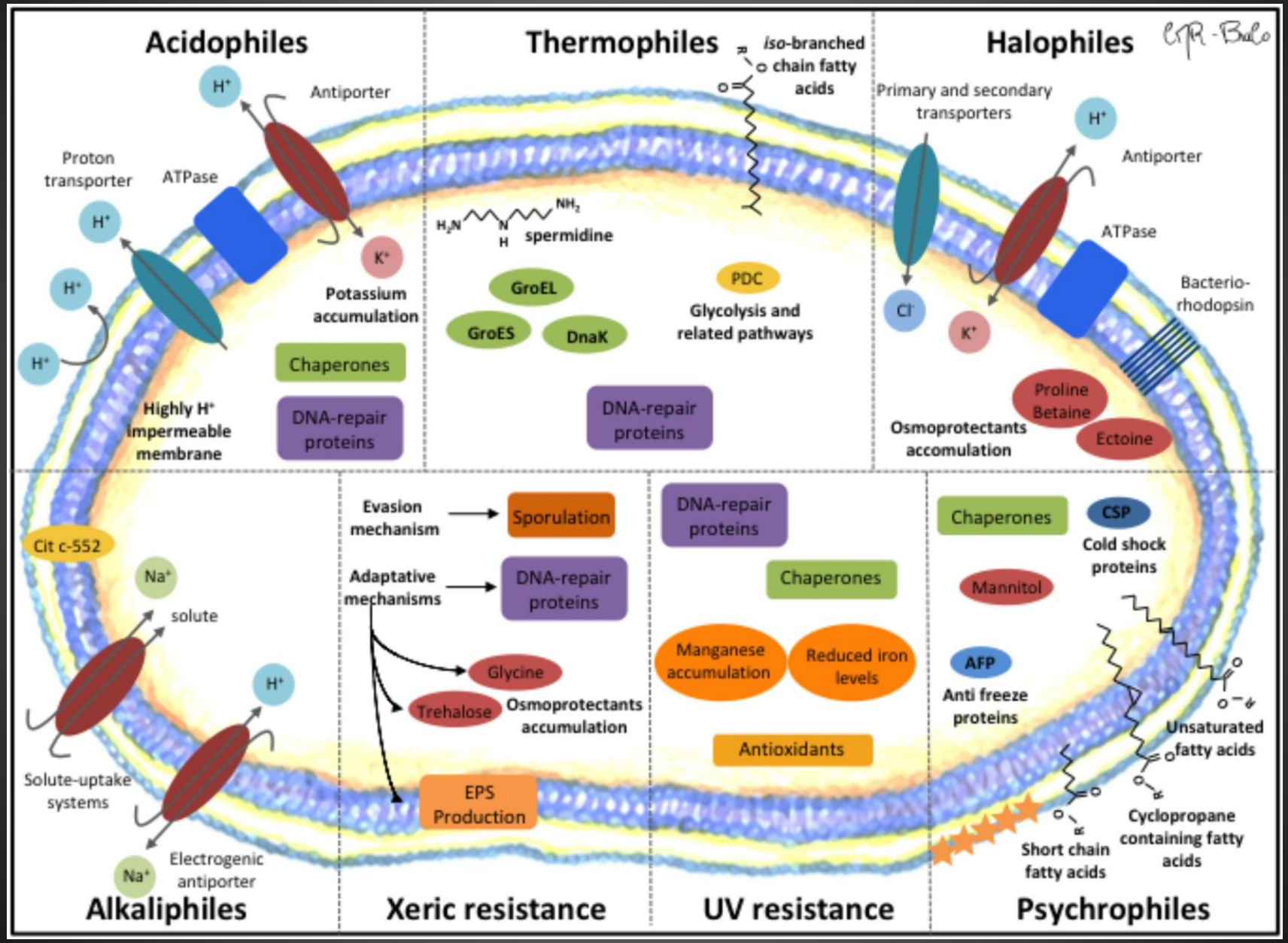
- Therefore, general concern is that biology doesn't have to sit on the surface of the planet.
- Too many uncertainties to be rigid with the definition of habitable zone.
- Researchers have started exploring the possibilities of subsurface (Mars) and atmospheric (Venus) life.

What attract us to look for life in Venusians' clouds

- Suitable temperature and pressure in lower clouds.
- 400-1000 ppm H_2O at height of 50-60 km in Venus clouds (Morowitz et al., 1982).
- Presence of carbon.
- Micron size particulates.
- Absorbance of attenuated UV (Limaye et al., 2018).



Defense Mechanism



Orellana et al., 2018

Life Search in Venus Cloud's

- Better H_2O concentration.
- High density of particulates/micron size particles.
- Presence of light hydrocarbons.
- Lower UV radiation.