

Honors Seminar 292 — cheat sheet for 10/28/2019 — Andrew Baker

Neish et al. (2018)

You should read pp 2–14, pp 19–22, and pp 24–25 of the PDF version of this article. Key questions:

1. Why do the authors prefer impact craters over cryovolcanoes as sites for studying possible prebiotic chemistry on Titan?
2. What is the significance of “atmospheric windows” for studies of prebiotic chemistry on Titan?
3. Why do the authors recommend *in situ* sampling rather than remote sensing for studying Titan?
4. What were the limitations of the *Huygens* lander for *in situ* studies of Titan’s surface?

Key terms:

- **aeolian** = adjective describing a process that is due to surface winds
- **bidirectional reflectance** = measurement of how light is reflected from an opaque surface
- **brecciated** = formed of breccias (i.e., rocks consisting of fragments embedded in a matrix of smaller grains)
- **clastic** = adjective describing rock that incorporates fragments from preexisting rock
- **cryolava** = watery material erupting from below the surface of an icy moon, analogous to molten lava erupting from below the surface of the Earth
- **ejecta blanket** = material spread over the area around an impact crater as a result of the impact
- **fluvial** adjective describing a process that is due to flows of surface liquid
- **gas chromatography** = technique for analyzing the chemical composition of a material that can exist in gaseous form
- **ice I** = ordinary ice that floats in liquid water
- **liquidus** = temperature above which a substance is fully liquid
- **peritectic** = melting point of a mixture of two substances when that melting point is lower (in temperature) than the melting point of either substance separately
- **photochemistry** = chemical reactions driven by light
- **Schumann resonance** = an electromagnetic resonance that occurs between two nested conductors (first identified in the context of the Earth and its ionosphere)

- **tidal Love number** = number quantifying the rigidity of a planetary body in response to tidal forces (for a perfectly rigid body, it has a value of zero)

Khawaja et al. (2019)

You should read the abstract, sections 1 and 2, and the first three and last three paragraphs of section 7. Key questions:

1. What are the three types of ice grains that have been detected in the vicinity of Enceladus?
2. How do the authors suggest that different types of organic compounds have been incorporated into Enceladean ice grains?
3. Why (in Section 7) do the authors speculate that there could be even more complex organic molecules in the ocean on Enceladus than the ones they have detected in its ice grains?

Key terms:

- **amine** = a chemical compound that includes a nitrogen atom and a lone pair of electrons
- **carbonyl** = a chemical compound that includes an oxygen atom double-bonded to a carbon atom
- **Friedel-Crafts reactions** = chemical reactions capable of adding chemical units to the aromatic (i.e., benzene) ring of a hydrocarbon
- **Hill sphere** = the volume in which an astronomical body is gravitationally dominant over others in its vicinity
- **Lost City** = a set of hydrothermal vents in the middle of the Atlantic Ocean
- **mmol** = millimole = 6.022×10^{20} particles (a measure of the amount of a substance)
- **serpentinization** = a geological process that changes the properties of rocks, notably on Earth's sea floor at the boundaries between tectonic plates
- **vapour adsorption** = attachment of atoms or molecules from a vapor to the surface (e.g., of an ice grain)
- **vapour pressure** = the pressure exerted by a vapor in equilibrium with its solid or liquid form at a fixed temperature (a substance that evaporates more easily will have a higher vapor pressure)
- **VOC** = volatile organic compound