

# Formation of Exobiological Molecules on Titan's Sub-surface and Lake Beds

- Are there exobiological molecules being formed at Titan?
- Based on Cassini observations we find that precursor molecules and amino acids can form within Titan's sub-surface and methane lake beds. KV O<sup>+</sup> ions from Enceladus impact Titan's upper atmosphere and get trapped inside Titan aerosols that settle onto the surface and lake beds. GCR irradiation can reach the surface and sub-surface ~ 450 Myrs and convert them into tholins & precursor molecules.

Hydrolysis from > 10 km meteor impacts ~ 450 Myrs convert precursors to amino acids with glycine abundances ~ 2.5-5 ppb.

- Impact is life forms different from ours may not be required at Titan.
- Important to scientific community is it provides an unanticipated path for making exobiological molecules from which life forms could develop.
- [www.elsevier.com/locate/icarus](http://www.elsevier.com/locate/icarus) Sittler et al., Icarus, in press, 2019.

