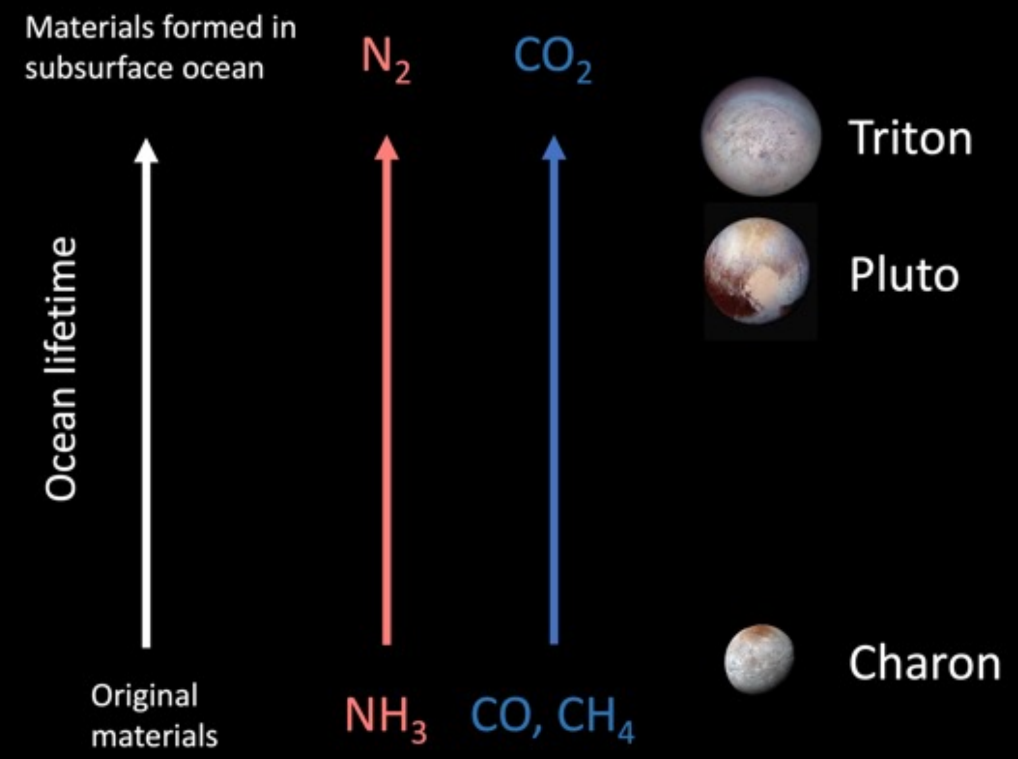
Triton's Subsurface Ocean Lasted Longer Than Pluto's

Triton and Pluto likely have or once had subsurface liquid-water oceans that are most readily detected by measurements from an orbiting spacecraft, but their presence can also be inferred using indirect methods. For example, the chemistry that takes place in an ocean gradually changes the atmospheric and surface compositions from their initial building blocks.

By observing the molecular species in the atmospheres and on the surfaces of Triton and Pluto, a team led by a Goddard scientist found evidence of such chemical changes and demonstrated that oceans likely once existed under the surfaces of these frozen bodies. The method they used involved measuring the relative amounts of nitrogen- and carbon-bearing compounds.

The building blocks of Pluto and Triton likely had a comet-like composition, with most nitrogen in the form of ammonia (NH_3) and much more carbon than is found on either body today. In contrast, the modern-day nitrogen detected on Pluto and Triton is mostly molecular nitrogen (N_2). These changes can be attributed to the action of subsurface ocean chemistry, and the relative amounts of CO_2 and CH_4 detected on Pluto and Triton suggest that Triton's subsurface ocean chemistry lasted longer than Pluto's.



Subsurface ocean chemistry converts (oxidizes) NH_3 to N_2 and CO & CH_4 to CO_2 over time. The relative amounts of these compounds found in planetary atmospheres and surfaces is evidence for subsurface oceans on icy Solar-System bodies. The higher abundances of N_2 and CO_2 in Triton compared to Pluto suggest a longer ocean lifetime on Triton.

Mandt, K. (693), Luspay-Kuti, A., Mousis, O., & Anderson, S. E. (2023). Surface Volatile Composition as Evidence for Hydrothermal Processes Lasting Longer in Triton's Interior than Pluto's. *The Astrophysical Journal*, 959 (1), 57.