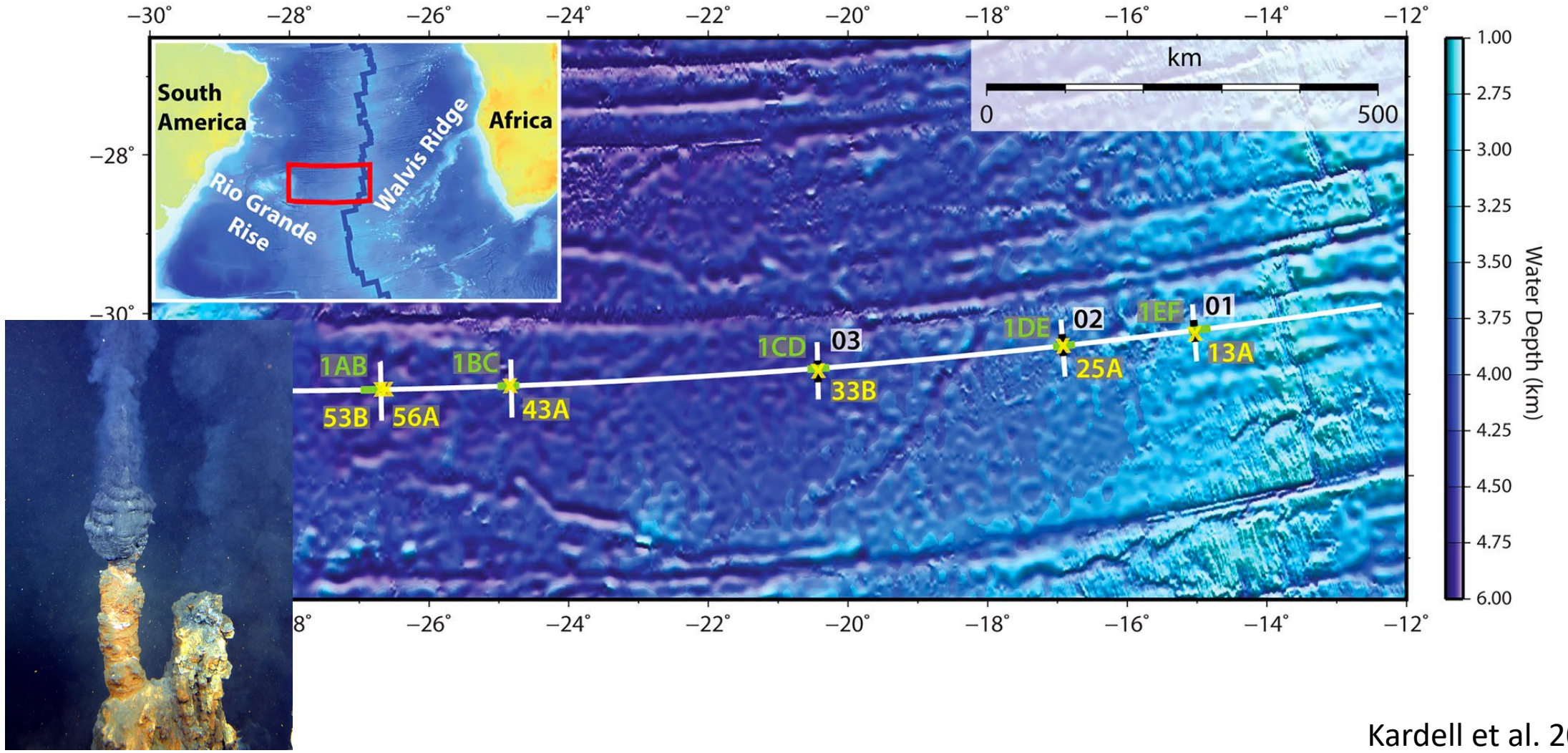
GEO 325M Spring 2022

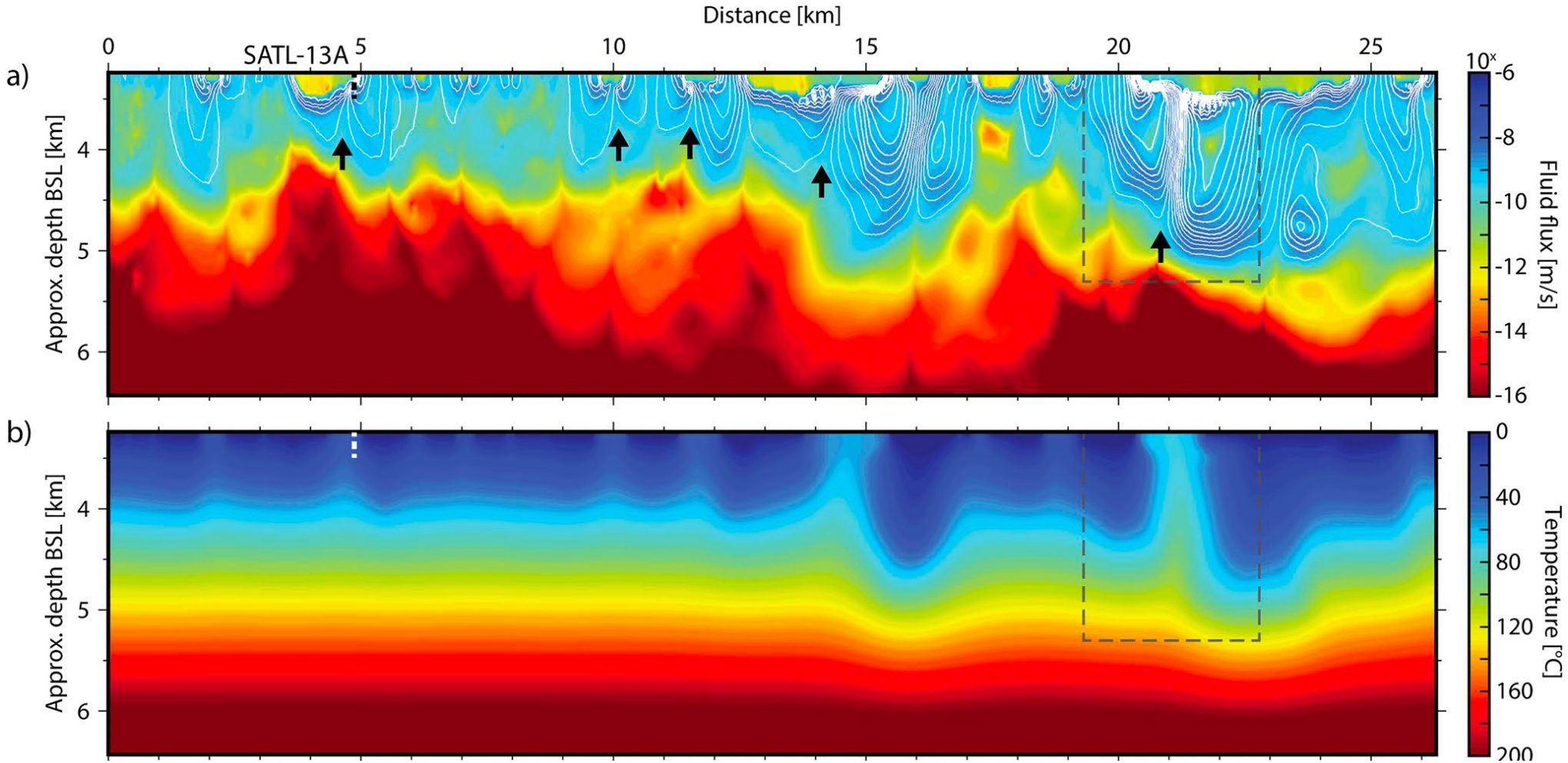
Class project: Hydrothermal convection in Earth and Planetary Processes

Hydrothermal convection in ocean floor



Kardell et al. 2021

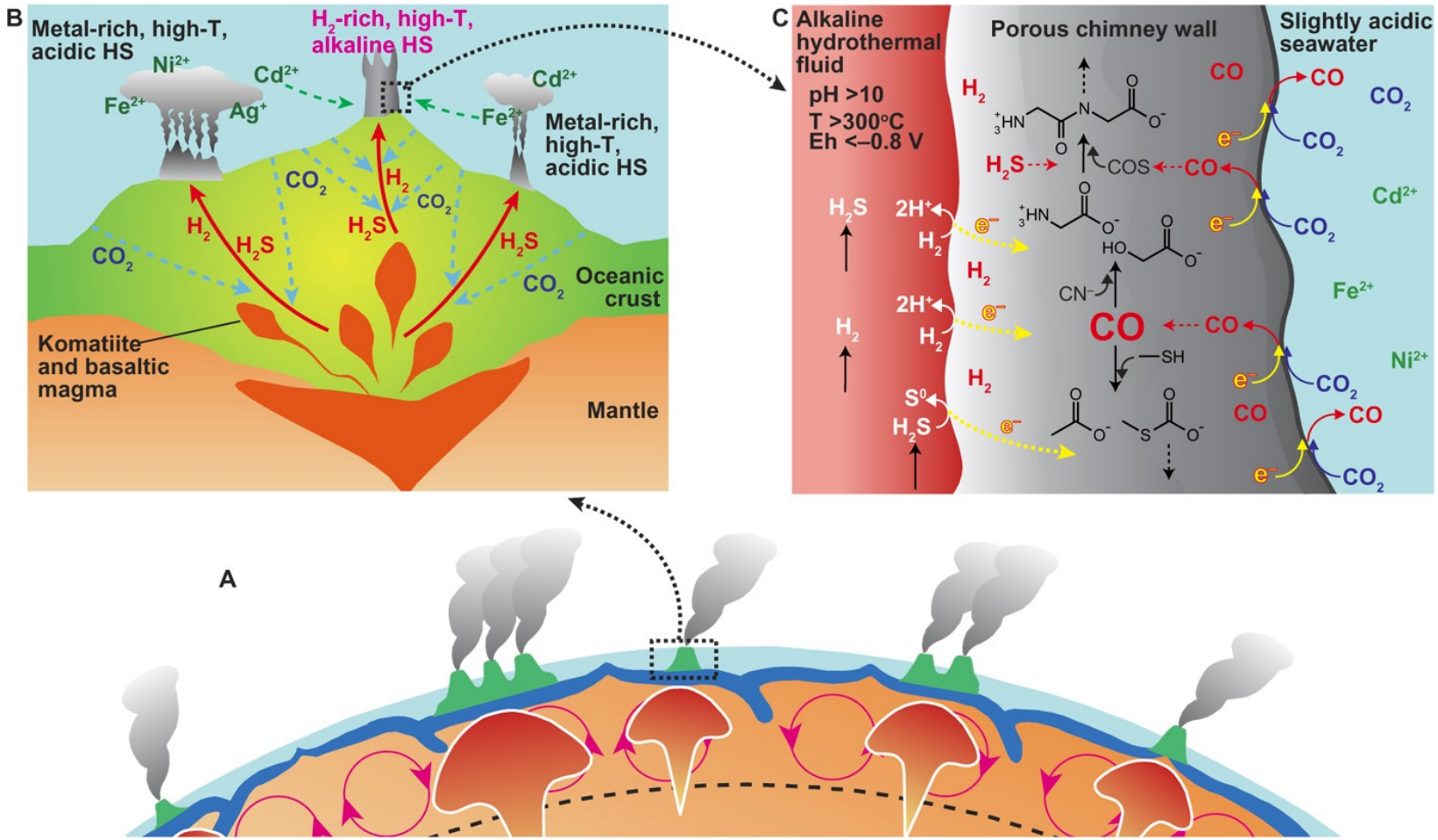
Hydrothermal convection in ocean floor



=> Simulation build with class tools!

Kardell et al. 2021

Origin of life in hydrothermal systems



Kitadai et al (2018)

Astrobiological interest ocean worlds

World	Liquid water volume	World volume	% liquid water
Enceladus	0.01 ZL	0.07 ZL	20%
Triton	0.03 ZL	10.35 ZL	0.3%
Dione	0.14 ZL	0.74 ZL	19%
Pluto	1.0 ZL	7.01 ZL	15%
Earth	1.335 ZL	1,083.21 ZL	0.12%
Europa	2.6 ZL	16.06 ZL	16%
Callisto	5.3 ZL	58.63 ZL	9%
Titan	18.6 ZL	71.60 ZL	26%
Ganymede	35.4 ZL	76.29 ZL	46%

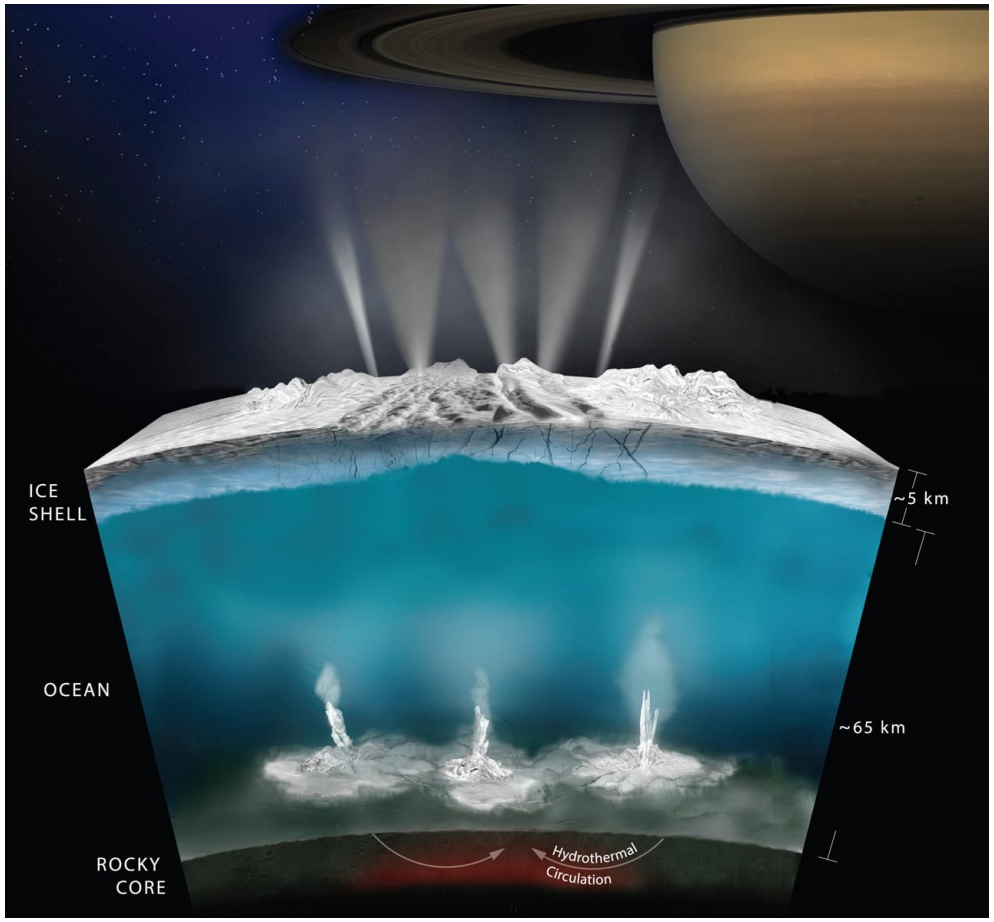
Earth has a surprisingly small amount of water compared to other worlds in the Solar System.

Each measurement shows the volume of the world and its stores of liquid water (ice not included).

1 zettaliter (ZL) = 1,000,000,000,000,000,000,000 liters

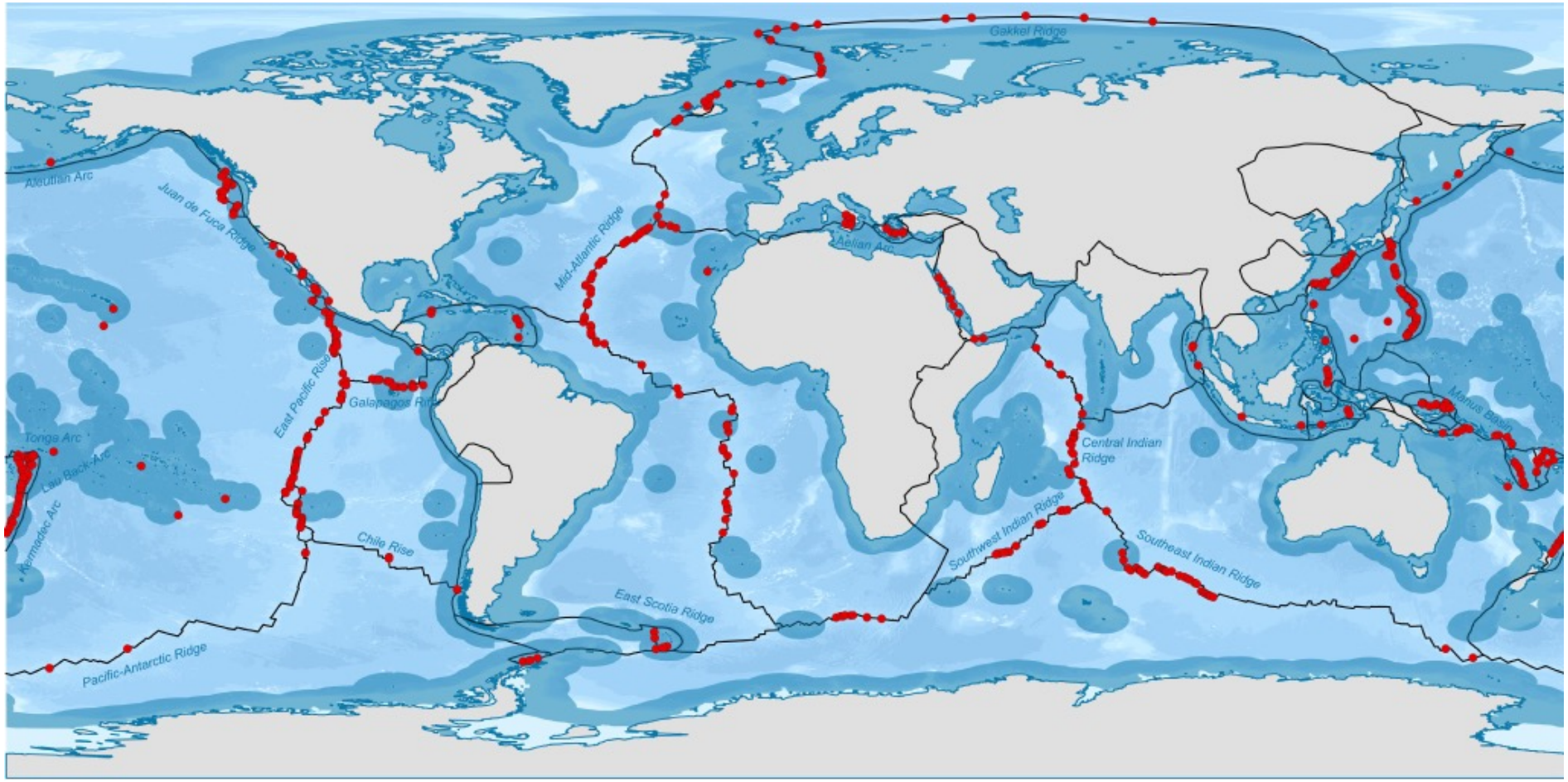
Source: Steve Vance; NASA/JPL-Caltech; NOAA National Geophysical Data Center

BUSINESS INSIDER



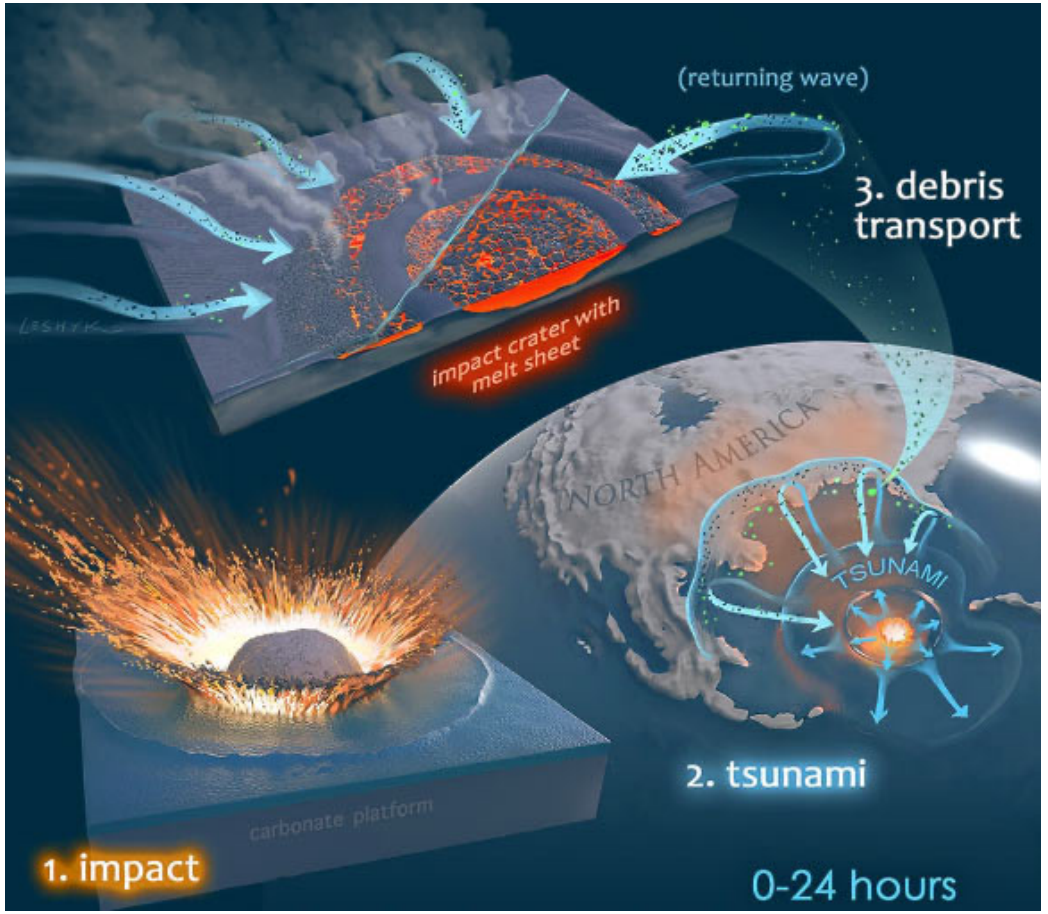
Is there life in the internal oceans of the moons of Jupiter and Saturn?

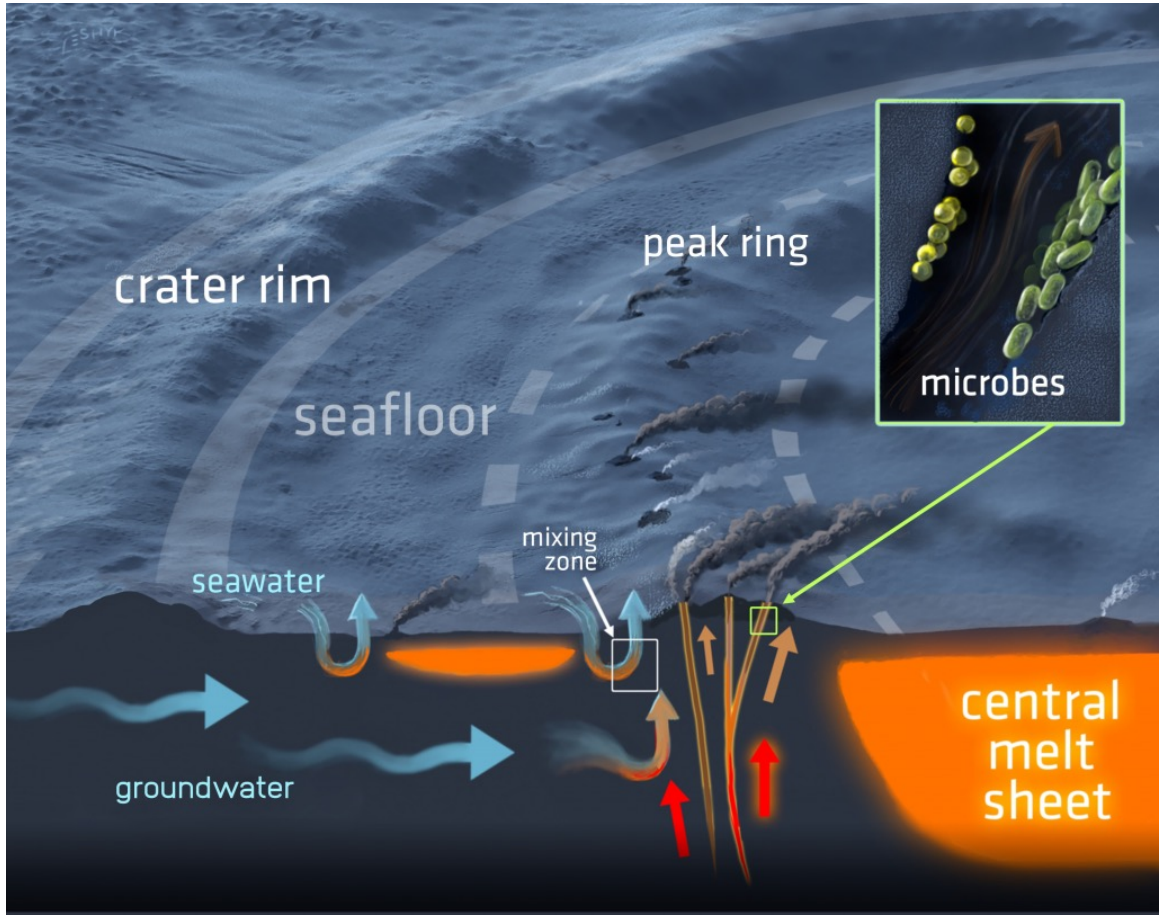
Hydrothermal vents => mid-ocean ridges



Does this limit life to planets/moons with plate tectonics?

Post-Impact Hydrothermal Systems

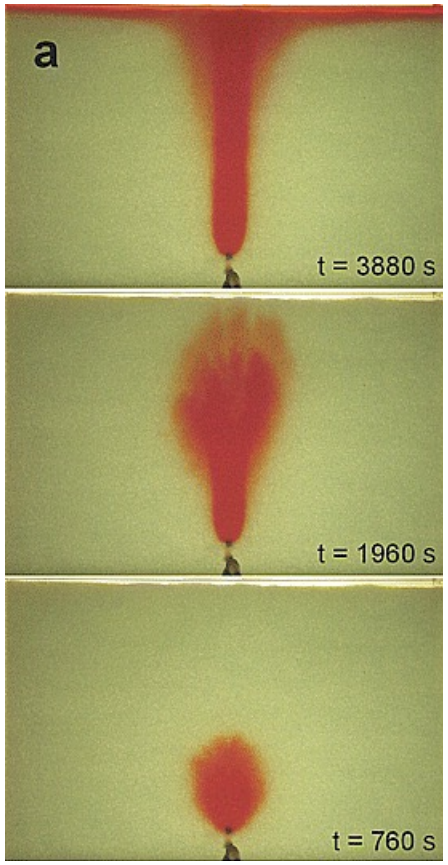




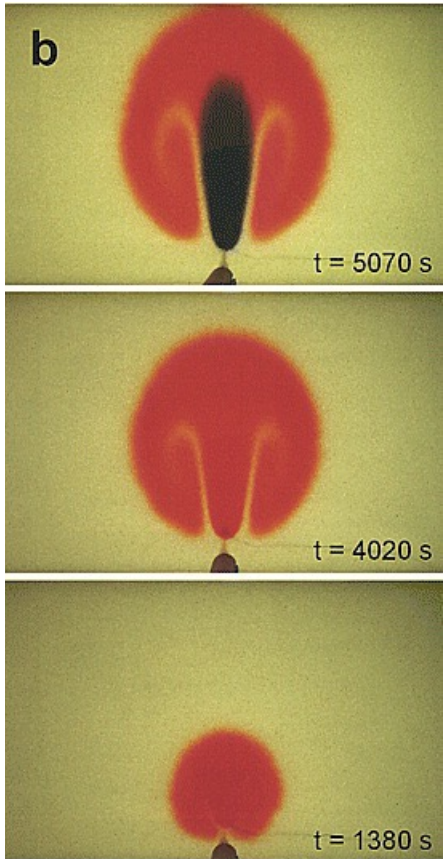
Impact craters can generate long-lasting hydrothermal systems.
Suitable for origin of life?

Double diffusive convection

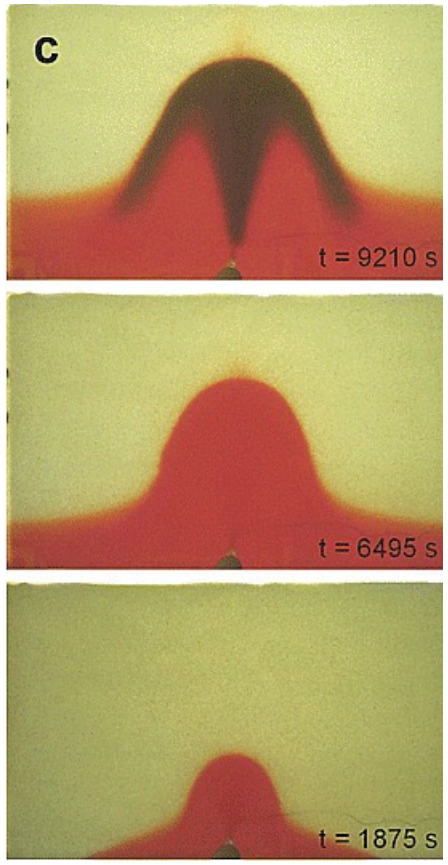
Menand et al 2003



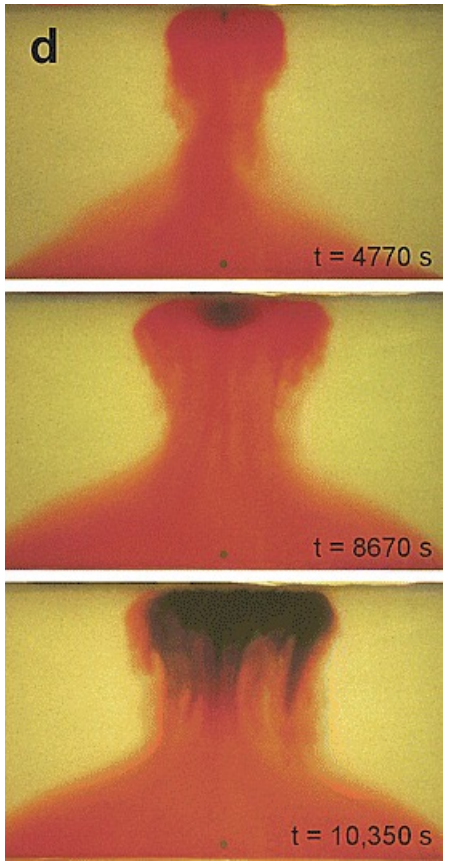
less salty, same T
injected at base



same salinity, hotter
injected at base



more salty, hotter
injected at base



more salty, hotter
injected at top