Emergence of life and differentiation of a shallow biosphere on Europa

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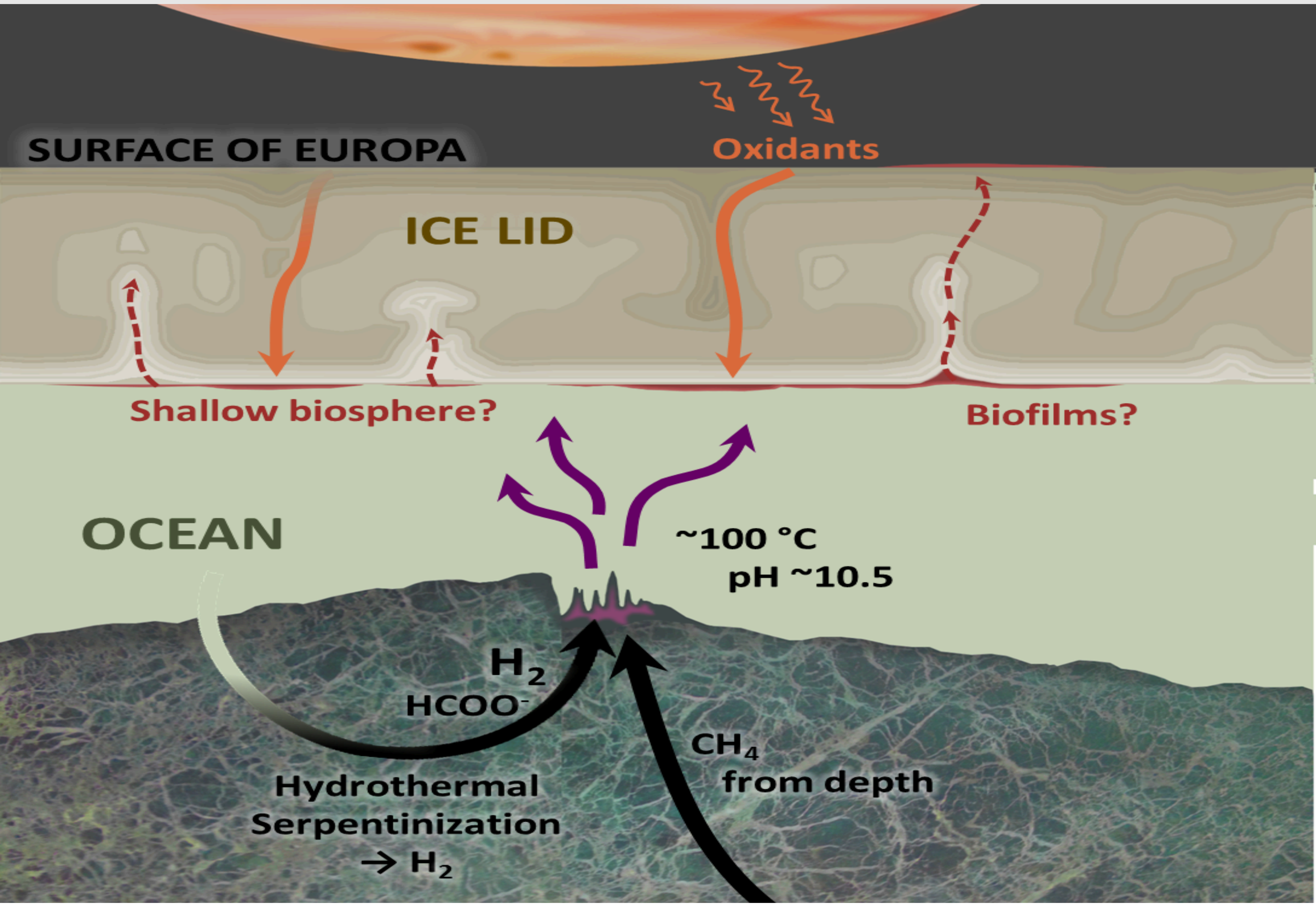
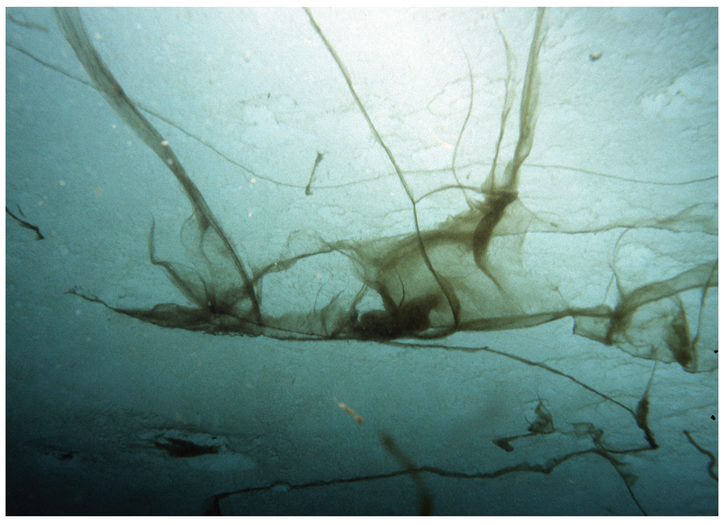
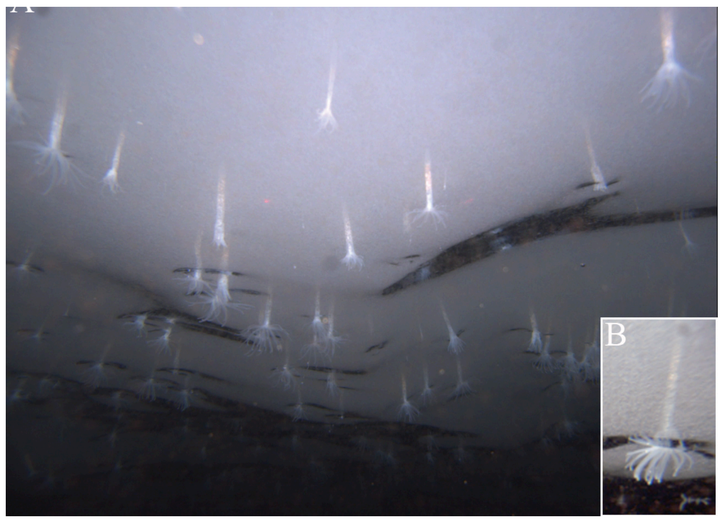


Model for the emergence of life on Europa and a hypothesized rapid migration of microbes originating at this vent entrained within buoyant thermal plumes toward oxidant-rich areas at the base of the ice lid (Russell, Nitschke, 2017; Russell, Murray, Hand 2017). These areas act as 'electron disposal units' and are derived through subsumation and/or subduction of oxidants from the exterior produced by high-energy electron-radiation from Jupiter (Bolton et al., 2002). In turn, portions of this shallow biosphere maybe returned to the surface through ice tectonics or sucked into the source regions of water vapor/ice jets (Roth et al., 2014; Sparks et al., 2016; Lorenz, 2016). Along with the standard methods for flying through plumes and analyzing the surface and deploying landers, future missions could use JPL's 'Under-Ice Buoyant Rovers for Exploration' of the putative shallow biosphere (Ananthaswamy, 2013). Ice shell partly based on Showman and Han, 2005; Kalousová et al., 2014).





Left: Macroscopic filamentous life forms attached to the underside of the sea ice. (© AWI/Gutt, doi:10.1594/PANGAEA.820720). Right: The underside of the Ross Ice Shelf has recently harbors fields of a sea anemone living embedded embedded in the ice (Murray et al. 2016).

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