Proteolipid entrapment of water

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We consider an ancient protein, and water as a smooth surface, and show that the interaction of the two allows the protein to change its hydrogen bonding to encapsulate the water. This property could have made a three-dimensional microenvironment 3-4 Gyr ago for the evolution of subsequent complex water based chemistry. Proteolipid, when presented with a water surface, changes its hydrogen bonding from an α-helix to β−sheet-like configuration and moves away from its previous association with lipid to interact with water surface molecules. Protein sheets with an intra-sheet backbone spacing of 3.7Å and inter-sheet spacing of 6.0Å, hydrogen bond into long ribbons or continuous surfaces to completely encapsulate a water droplet. The resulting morphology is a spherical vesicle or a hexagonal crystal of water ice, encased by a skin of proteolipid. Electron diffraction shows the crystals to be highly ordered and compressed and the protein skin to resemble β-sheets. The protein skin can retain the entrapped water over a temperature rise from 123K to 223K (-150 to -50C) at 1e-4Pa, whereas free water starts to sublime significantly at 153K (-120C). That the protein appears to polymerize lengthwise to form stands many hundreds of nm long, implies some peptide condensation on the water surface is also occurring. Strecker in the 1850's demonstrated amino acid formation from aldehydes and ketones, and Fox et al starting in the 1950's amino acid condensation to protein in water, and the further formation of microspheres, which were suggested as potential structures for the start of life. We are now attempting to demonstrate entrapment of water via amino acid condensation on water in ultra-clean air, where the starting components are just water droplets and single amino acids.

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