The "refoldability" of selected proteins in ionic liquids as a stabilization criterion, leading to a conjecture on biogenesis.

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The folding of proteins is usually studied in dilute aqueous solutions of controlled pH, but it has recently been demonstrated that reversible unfolding can occur in other media. Particular stability is conferred on the protein (folded or unfolded) when the process occurs in "protic ionic liquids" (pILs) of controlled proton activity (PA). This activity ("effective pH") is determined by the acid and base components of the pIL and is characterized in this study by the proton chemical shift of the N-H proton. Here we propose a "refoldability" or "refolding index" (RFI) metric for assessing the stability of folded biomolecules in different solvent media, and demarcate high RFI zones in hydrated pIL media using ribonuclease A (Rnase A) and hen egg white lysozyme (HWL) as examples. Then we show that, unexpectedly, the same high RFIs can be obtained in pIL media that are 90 % inorganic in character (simple ammonium salts). This leads us to a conjecture related to the objections that have been raised to "primordial soup" theories for biogenesis, objections that are based on the observation that all the bonds involved in biomacromolecule formation are hydrolysed in ordinary aqueous solutions unless specifically protected. The ingredients for primitive ionic liquids (NH_3, CO, HCN, CO_2 and water were abundant in early earth atmosphere, and many experiments have shown how aminoacids could form from them also. Cyclical concentration in evaporating inland seas could easily produce the type of ambient temperature, non-hydrolyzing, media that we have demonstrated here may be hospitable to biomolecules, and which may be actually encouraging of biopolymer assembly. Thus a plausible variant of the conventional "primordial soup" model of biogenesis is suggested.