Phosphorylation on the Prebiotic Earth

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The formation of organophosphate bonds is stymied by poor reactivity of phosphate minerals towards organics. Recently, we have demonstrated that the meteoritic mineral schreibersite—$(Fe,Ni)_3P$—is capable of phosphorylating the simple organic compound glycerol and nucleosides to make nucleotides. The phosphorylation pathway here relies on the intrinsic oxidation of P from a near zero oxidation state to a +5 in phosphate.

In this presentation, I outline the possible routes to phosphorylation that may have been active on the early earth. These include phosphorylation within non-aqueous solvents such as deep eutectic solvents, phosphorylation by means of reactive intermediates produced by oxidation of reduced P compounds, and phosphorylation by activation. The plausibility of these pathways depends on the environment of the early earth. Ultimately, it is plausible that phosphorylation was predestined on the early earth as a consequence of its geochemistry.