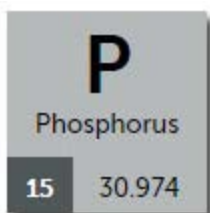


## *The Primordial Chemistry of Phosphorus*



The element phosphorus has geo-, bio-chemical importance to cosmochemists and astrobiologists who are studying primordial prebiotic chemistry in our Solar System and the origins of life. Phosphorus, in this context, is commonly studied in volatile forms, such as the gas phosphine ( $\text{PH}_3$ ), in phosphide minerals found in meteorites, for example schreibersite  $(\text{Fe,Ni})_3\text{P}$ , and in phosphate minerals, such as apatite  $\text{Ca}_5(\text{PO}_4)_3(\text{OH,F,Cl})$ .

Matthew Pasek (University of South Florida) is investigating the different forms and distribution of phosphorus that likely existed, and contributed to building the initial materials, in our early Solar System. One of the key questions Pasek's work addresses: Was phosphorus a volatile component of gases or ices in our young, outer Solar System?

Pasek proposes that volatile forms of phosphorus were not abundant or persistent in the early history of our Solar System. The results of his work are based on metal-phosphorus reaction rates he determined from experiments combined with a condensation-sequence model for phosphorus and a simple gas diffusion model. Pasek's research supports the idea that with decreasing temperatures from an initially hot system, phosphorus reacted with iron-nickel metal forming phosphides relatively early and rapidly, effectively removing volatile phosphorus in the evolving Solar System. Pasek further suggests that if any  $\text{PH}_3$  gases were trapped in ices and slowly released in the interior of a planetesimal, the  $\text{PH}_3$  gas could have reacted with metal even at the low temperatures of the outer Solar System over 4.5 billion years.

See Reference:

· Pasek, M. A. (2019) Phosphorus Volatility in the Early Solar Nebula, *Icarus*, v. 317, p. 59-65, doi: 10.1016/j.icarus.2018.07.011. [[article](#)]

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