FILTERING ALGORITHM FOR BIOSIGNATURE CLASSIFICATION OF CNOSPH COMPOUNDS ON VENUS. P. A. Johnson[1], J. C. Johnson[2], and A. Mardon[1]. [1]University of Alberta (116 St 85 Ave NW, Edmonton Alta., Canada; paj1@ualberta.ca), [2]University of Alberta (116 St 85 Ave NW, Edmonton Alta., Canada; jcj2@ualberta.ca),

Introduction: In September 2020, phosphine (PH_3) was first detected in the Venusian atmosphere by the Atacama Large Millimeter Array (ALMA) telescope. It was posited not to derive from an abiotic source due to unfavorable climatology, processes, and environment on the planet [1] (Fig.1).

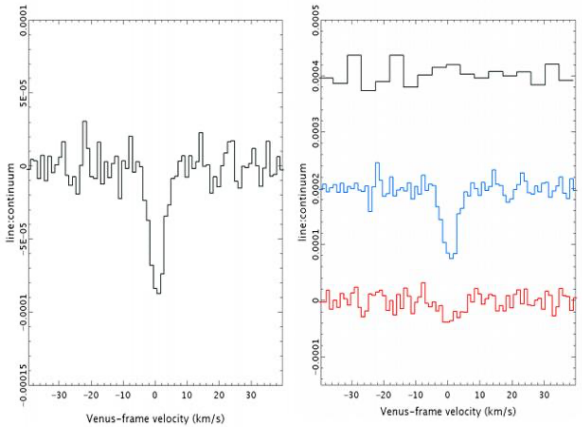

Fig. 1. Spectra of Venus obtained with ALMA offset for clarity. Reproduced from Greaves et al. [1] ALMA data reduction

Notably, the compound would not persist in the atmosphere due to high levels of ultraviolet radiation that would ultimately react with water and carbon dioxide. Moreover, no known abiotic process on terrestrial planets generates this gas byproduct. Thus, the detectable presence of PH_3 in the atmosphere is suggestive of a biotic source of the molecule.

Methods: We performed a search of databases across published literature utilizing incorporated filtering algorithms for biosignatures in the context of PH_3, comparing product molecules, comprising of only CNOSPH compounds, synthesized by life. Additionally, we considered all volatile gases in our search for reliable biosignatures.

Results: The manual search yielded a database of results which can be utilized to identify prospective biosignatures in the search for life (Fig.2; Fig.3).

Though unable to determine a biotic or abiotic origin for phosphine, it revealed a number of theories which may be considered. Recently, several novel proposals have emerged regarding abiotic sources of phosphine. Perhaps the source of the compound may be of volcanic origin. A previous proposal considered geological weathering of olivine lavas that contain inorganic phosphides. This novel proposal speculates the extrusion of large quantities of PH_3 from the mantle core.

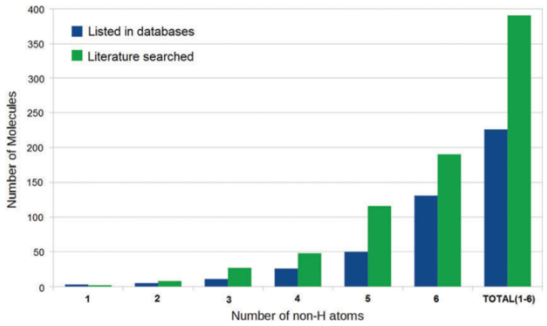

Fig. 2. Comparison of molecules produced by life as found in published databases and found by a manual literature search. For CNOPSH compounds only.

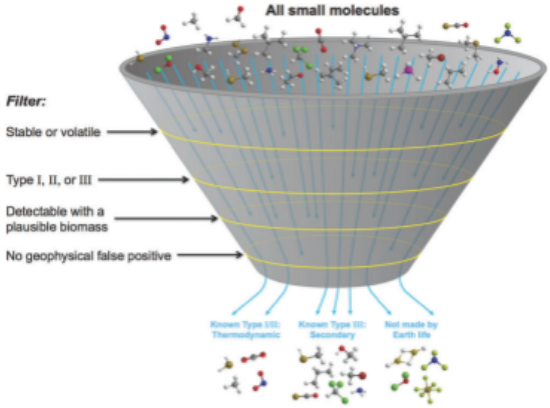

Fig. 3. Filtering algorithm considering all volatile molecules in the search for useful biosignature gases.

References: [1] Greaves, J. S. et al. (2020). "Phosphine gas in the cloud decks of Venus". *Nature Astronomy*: 1–10. [2] Truong, N. & Lunine, J. I. (2021). "Volcanically extruded phosphides as an abiotic source of Venusian phosphine". *Proceedings of the National Academy of Sciences*. 118 (29). [3] Johnson, J. C., et al. (2020). "Prospecting Microbial Biosignatures from Venusian Clouds". In 18th Meeting of the Venus Exploration Analysis Group (VEXAG) 18 (No. 2356): 8024.