Ice as matrix for chemical evolution: Synthesis of polycyclic aromatic hydrocarbons in frozen environment by spark discharges.

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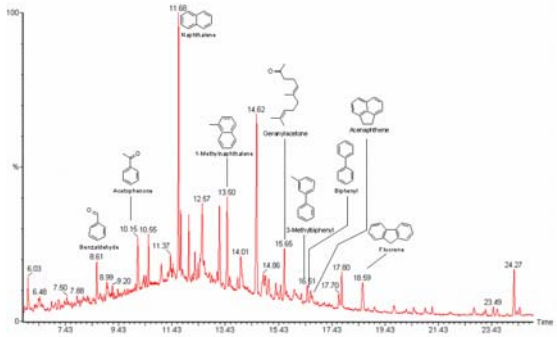
It has been demonstrated that frozen water is a suitable matrix for high order chemistry, such as the oligomerization of nucleotides[1]. In this work we propose that frozen water with realistic temperature variations could be an attractive model in lower order chemistry, boosting the chemical evolution of the organic molecules synthesized by the effect of spark discharges on a suitable prebiotic atmosphere.

Our experiment creates a melting-freezing cycle of a liquid water pool under a $CH_4/N_2/H_2$ atmosphere. After the generation of organic matter by means of spark discharges during 72 h, the system was maintained sealed and the melting-freezing cycle stablished during 3 months.

After that, the organic solution in the reactor device was analyzed by solid phase microextraction (SPME) coupled with GC-MS. We found a set of polycyclic aromatic hydrocarbons (PAHs) and other aromatic compounds as acetophenone or benzaldehyde (see figure).

PAHs are recognized as key molecules in the study of the origin of life, due to their photochemical properties i.e. as primitive pigment systems that drive synthesis of amphiphilic compounds [2]; with the freezing-melting cycle, we found a stable environment that could be conductive to the synthesis and accumulation of PAHs and prebiotic organic molecules on Mars, Europa, Titan or early Earth.



References

[1] Trinks H., Schröder W., Biebricher C.K. (2005) *Origins Life Evol. Biosph.* **35,** 429-445.

[2] Segré D., Ben-Eli D., Deamer D.W., Lancet D. (2001) *Origins Life Evol. Biosph.* **31,** 119-145.