

Understanding bio-volatilization pathways of trace metal(loid)s (Hg, Se, Sn, ...) in aquatic environments: Field and lab approaches

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The accurate biogeochemical cycle of major and trace elements at various scales has been widely investigated, but has provided a paradigm for metals and metalloids. While most of the lighter elements (C, N, S) are involved in the basic life processes in the environment and the production of “biogenic” gases, the atmospheric transfer of the heavier elements is less recognised. Metal(loid)s can form volatile species mainly after reduction and/or alkylation processes. These pathways are a consequence of biological activity or indirect abiotic reactions. Here we discuss and synthesize several field and laboratory biogeochemical studies performed on the formation natural alkylated species of mercury (Hg), selenium (Se), tin (Sn) and other miscellaneous elements.

Investigations in marine and estuarine environments, but also in pristine or polluted continental ecosystems suggest that volatilisation of metal(loid)s through natural processes can be a major pathway in their biogeochemical cycles [1] [2]. Like dimethyl sulfide (Me₂S), all heavier chalcogenides (Se, Te, Po) have volatile alkyl species [1] [3]. In aquatic ecosystems, formation and volatilisation of dimethyl selenide (Me₂Se), dimethyl mercury (Me₂Hg) or methylated butyltin (Bu₃SnMe), respectively, can be an efficient process to remobilise these elements via the atmosphere [2]. In this context, the recent development of non-traditional isotope investigations allows now to provide an isotopic constrain on the biogeochemical reactivity of some trace elements (Hg, Se, ...) and their biogenic volatilization pathways [4].

[1] Amouroux, Liss, Tessier, Hamren-Larsson & Donard (2001) *Earth & Planetary Science Letters* **189**, 277-283. [2] Tessier, Amouroux & Donard (2003) *ACS Symposium Series* **835**, 151-165. [3] Bahrou, Ollivier, Hanson, Tessier, Amouroux & Church (2012) *Environmental Science & Technology* **46**, 11402-7. [4] Perrot, Jimenez-Moreno, Bérail, Epov, Monperrus & Amouroux (2013) *Chemical Geology* **355**, 153-162.