Towards the *in vitro* methylation of metals and metalloids: Capability of corrinoid-dependent methyltransferases from *Methanosarcina mazei* to volatilize metal(loid)s

Frank Thomas[1], Britta Huber[1], Roland A. Diaz-Bone[2], Reinhard Hensel[1]

[1]Microbiology I, University of Duisburg-Essen, Universitätsstraße 3-5, 45117 Essen, Germany

[2]Institute of Environmental Analytical Chemistry, University of Duisburg-Essen, Universitätsstraße 3-5, 45141 Essen, Germany, roland.diaz@uni-due.de

Formation of volatile metal and metalloid-organic compounds (in general methylated or hydrated derivatives) by microorganisms are widespread in anaerobic habitats like sewage-sludge, geothermal vents as well as intestinal tracts of mammalian species including human. In most cases, these compounds represents methylated derivatives of metal(loid)s and exhibit a higher toxicity than their inorganic educts. As indicated by recent studies, methylation of metal(loid)s appears to be an inherent feature of methanoarchaea. Nevertheless, the biochemical mechanisms of the synthesis of these methylated derivatives is still poorly understood.

Here, two corrinoid-dependent methyltransferases (MtaA and MtbA) involved in the central energetic metabolism of the methanoarchaeum *Methanosarcina mazei* were heterologously expressed, purified and tested for their capability to transform inorganic metal(loid)s into volatile derivatives. We present evidence that these two methyltransferases are able to transform different inorganic metal(loid)s (As, Se, Te, Sb and Bi) into volatile derivatives including both methyl and hydride species. The spectrum of elements derivatized by these proteins is similar to the biotransformation spectrum of *M. mazei in vivo*. The enzymatic properties of the methyltransferases regarding substrate specificity are analyzed and putative reaction mechanisms discussed.