

**Can direct extracellular electron transfer occur in the absence of outer membrane cytochromes in *Desulfovibrio vulgaris*?**

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Extracellular electron transfer has been investigated over several decades via forms of soluble electron transfer proteins that are exported for extracellular reoxidation. More recently, several organisms have been shown to reduce extracellular metals via the direct transfer of electron through appendages; also known as nanowires. They have been reported most predominantly in *Shewanella* and *Geobacter*. While the relevancy and composition of these structures in each genus has been debated, both possess outer membrane cytochrome complexes that could theoretically come into direct contact with solid phase oxidized metals. Members of the genus *Desulfovibrio* apparently have no such cytochromes although similar appendages are present, are electrically conductive, and are different from flagella. Upon U (VI)-reduction, the structures in *Desulfovibrio* become coated with U (IV). Deletion of flagellar genes did not alter soluble or amorphous Fe (III) or U (VI) reduction, or appendage appearance. Removal of the chromosomal *pilA* gene hampered amorphous Fe (III)-reduction by ca. 25%, but cells lacking the native plasmid, pDV1, reduced soluble Fe (III) and U (VI) at ca. 50% of the wild type rate while amorphous Fe (III)-reduction slowed to ca. 20% of the wild type rate. Appendages were present in all deletions as well as  $\Delta$ pDV1, except  $\Delta$ *pilA*. Gene complementation restored all activities and morphologies to wild type levels. This suggests that *pilA* encodes the structural component, whereas genes within pDV1 may provide the reactive members. How such appendages function without outer membrane cytochromes is under investigation.

**Arsenic distribution in laterites of the Balkan Peninsula and its environmental significance**

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Arsenic contents in large laterite deposits are <2 to a few decades ppm. However, As contents in bauxitic-laterites from Larymna, lying on karstified Jurassic limestone, vary significantly from <2 ppm to 2600 ppm, and are accompanied by elevated Co, Ni, Th, U and REE as well. Also, As contents in the yellow-grey colored bauxite ores of the Parnassos-Ghiona deposit, characterized by abundant pyrite and micro-organisms, reach values up to 1000 ppm. The latter bauxite type is common along faults, closed to overlain U. Cretaceous limestone, accompanied by thin layers of coal, which is considered to be the source As in laterites.

Arsenic ranging between 0.5 to 1.6 wt% As<sub>2</sub>O<sub>3</sub> is mainly hosted by Fe- and Al-oxides, cross-cutting matrix of an earlier stage. Sorption of both As (III) and As (V) form inner-sphere complexes on Fe-oxides, while As (III) forms outer-sphere sorption mechanisms on Al-oxides [1]. The calculated negative free energy ( $\Delta G$ ) values for arsenite and arsenate sorption onto Fe-oxides, positive entropy ( $\Delta S$ ) and positive enthalpy ( $\Delta H^\circ$ ) values suggest favourable sorption of arsenic onto laterite concretions [1]. Thus, although high As content in Ni-laterites may be unacceptable for the quality of the coming products, any influence of As-bearing laterites on the groundwater aquifer would be inconsistent with the sorption of arsenic in Fe- and Al-oxides. Instead both bauxites and Ni-laterites could be used to remove As from water.

[1] Partey (2008) Ph.D. New Mexico IMT, Dept of Earth & Environ. Science, p.177.