

## A new metallophore for the nitrogen fixing bacteria *Azotobacter vinelandii*

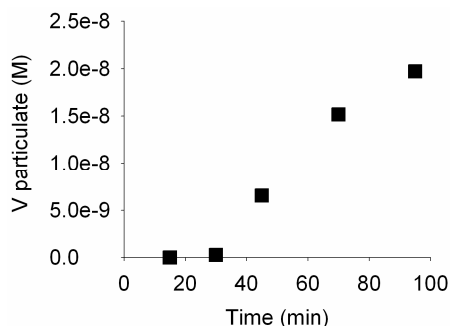
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Nitrogen fixation, which is responsible for the natural input of new nitrogen into ecosystems, is performed by N<sub>2</sub>-fixing bacteria using the enzyme nitrogenase. The Mo-nitrogenase is the most common and efficient form of the enzyme, but a V and a Fe-only nitrogenases, that are expressed when Mo is unavailable, have also been reported. The acquisition of Fe, Mo and V is thus essential for diazotrophic growth. The nitrogen fixing soil bacteria *A. vinelandii* excretes small organic ligands (siderophores) that bind Fe and increase its bioavailability [2-3]. Recently we reported that azotochelin, a bis(catechol) siderophore produced by *A. vinelandii* binds V(V) with a high affinity [1].

Here, we show that diazotrophic cultures of *A. vinelandii* use azotochelin as a vanadium carrier ("vanadophore") when Mo is limiting. Larger amounts of azotochelin (compared to other catechol compounds) are excreted in the growth medium when V is used for N<sub>2</sub> fixation. The V-azotochelin complex is taken up by the bacteria via a specific transport system that doesn't recognize other V-complexes (see Figure). Further, azotochelin can remove V from an unavailable DFB complex, resulting in an increase of uptake (see Figure). The transporter for V-azotochelin is regulated and shuts down at high (toxic) V concentrations.

Vanadium is the one of the first oxoanions, and the only transition metal with iron and copper, shown to have a high affinity uptake system involving a metallophore.



Short term uptake of V ( $4 \cdot 10^{-8}$  M V<sub>T</sub>,  $3 \cdot 10^{-4}$  M DFB (desferrioxamine B)) by *A. vinelandii* (CA 11.70).  $10^{-4}$  M azotochelin were added after 31 minutes.

### References

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## Proterozoic melt percolation event in supra-subduction mantle: Evidence from Voykar Ophiolite, Polar Urals.

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Mantle rocks of Voykar ophiolites could be subdivided into residual harzburgites (age over 2 Ga), dunites representing channels for migrating melts (Kelemen *et al.*, 1995) and pyroxenite veins (age 0.6 Ga). Clinopyroxene (CPX) presents in all these rocks and its trace element composition could give an information about migrating melt composition (represented by interstitial CPX in dunites), degree of melting and subsequent modification by percolating melts of residual harzburgite (CPX in harzburgites). Also CPX composition may shed light on the mechanism of pyroxenite veins formation.

We have analyzed CPX from 9 harzburgites, 13 dunites and 13 pyroxenites using LA ICP MS at Max Plank Institute for Chemistry. The most uniform compositions are displayed by CPX from pyroxenites yielding subparallel patterns of incompatible elements at primitive mantle normalized spider diagram. They show clear supra subduction zone signatures - HFSE (e.g. Nb and Zr) depletion and relative LILE (e.g. Sr) enrichment, representing therefore late stage supra-subductional melts and/or fluids. Such conclusion is confirmed by presence of magmatic amphibole in several samples of pyroxenites testifying presence of magmatic water. The better estimates of melt compositions thus require measuring of water contents in those amphiboles due to severe influence of water on crystal-melt partitioning coefficients (Sobolev *et al.*, 1996, Wood *et al.*, 2002).

CPX from harzburgites also display subparallel trends in MREE-HREE part of spectrum, but their LREE concentrations display different degrees of modification by percolating melts (e.g. Batanova *et al.*, 1998). CPX from dunites have the widest ranges of LREE/HREE ratios representing melts ranging from N-MORB-like melts to highly depleted in LREE melts which experienced reaction with large volume of residual rocks.

Data on olivine compositions still has to be evaluated.

### References

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