

***Shewanella* cell surface modification upon exposure to soluble cations**

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Shewanella putrefaciens CN32 is a metabolically versatile dissimilatory metal reducing (DMR) bacterium, and has been extensively examined with respect to its ability to reduce metals [1, 2], as well as its surface characteristics [3]. Products of DMR are usually soluble and can saturate the cell wall, but the consequences of this towards the physiology and structure of the cell surface are poorly understood. Our research with Mn(II) and V(IV) suggests that cell surfaces are modified in response to being grown in the presence of these metals, as well as to brief exposure when grown in a defined trace element medium. Cells maintain their viability after this exposure; however, fluorescence studies have revealed that the fluid state of the membrane changes dramatically across metal concentration, as well with oxygen presence.

Scanning transmission X-ray microscopy (STXM) was utilized to examine the near-edge X-ray absorption fine structure (NEXAFS) spectra of C, N, and O components of highly purified *Shewanella* membrane extracts. Our results support that soluble metals induce changes in cell membrane structure. NEXAFS spectra for Mn and V on these extracts, and subsequent speciation based on libraries of standards, suggest that these metals sorb to the cell surface in their reduced forms. Observations also confirm that cells grown anaerobically have different membrane compositions than those cultured in oxic conditions.

Geochemically, with respect to mineral formation or surface sorption, there are many hypothetical fates for reduced metals after DMR. From a cellular perspective, however, the physiological effects that these soluble metals induce in bacteria remains somewhat unclear. Environmental conditions for these cells are often complex and dynamic, and cell surface reactivity changes not only with the environment but across species as well. To this extent, controlled laboratory study observations are difficult to apply to environmental scenarios, but they still provide insight into response mechanics of bacteria towards target stimuli.

[1] Lloyd (2003) *FEMS Microbiol. Rev.* **27**, 411-425.
[2] Glasauer *et al.* (2003) *Geochim. Cosmochim. Acta* **67**, 1277-1288. [3] Korenevsky & Beveridge (2007) *Microbiol.* **153**, 1872-1883.

Revised zircon U-Pb ages for the Triassic–Jurassic boundary and the earliest Jurassic employing the chemical abrasion pretreatment (CA-TIMS) technique

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Here we report preliminary results of re-dating volcanic samples from the Triassic-Jurassic boundary (TJB) and the earliest Jurassic using the chemical abrasion pretreatment technique (CA-TIMS) on single zircons, which effectively eliminates the effects of Pb loss and allows for unambiguous recognition of age dispersion. The end of the Triassic period is marked by one of the five largest mass extinction events and concomitant changes in the global climate and carbon cycle. It therefore represents a critical interval for the Earth system, and assessing the chronology of events and rates of processes need a precise and accurately calibrated time scale. Key calibration points for the current geological time scale (GTS2004) are U-Pb ages of 199.6 ± 0.4 Ma from immediately below the TJB on Kunga Island (Queen Charlotte Islands, Canada) and $200.4 +2.7/-2.8$ Ma from the Middle Hettangian of Puale Bay (Alaska, US). The first one effectively serves as the best estimate of the TJB in GTS2004. Both determinations were obtained on air-abraded multi-grain fractions of zircons separated from volcanic ash layers intercalated in marine sediments with precise biostratigraphic age control, but the accuracy of the ages is compromised by unrecognized Pb loss (due to averaging effects from the use of multi-crystal samples for the former) and a combination of inheritance, Pb loss and age discordance for the latter age. Eleven single zircon grains were analyzed from the Kunga Is. TJB ash; three of them had minor inherited older Pb and one remained affected by Pb loss. A coherent cluster of seven analyses yields a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 201.7 ± 0.6 Ma that we regard as the crystallization age and use as the revised best estimate of the TJB age. Twenty single crystals were analyzed from the Puale Bay sample; one of them was affected by inheritance and another three showed Pb loss. Mutually overlapping results for sixteen single grains yield a median $^{206}\text{Pb}/^{238}\text{U}$ age of $200.8 +0.6/-0.4$ Ma (ages at 2σ precision with ^{238}U decay constant errors not included). Our results are in good agreement with recently reported CA-TIMS zircon U-Pb ages from Peru [1] which suggest 201.58 ± 0.28 Ma for the TJB and 199.53 ± 0.29 Ma for the Hettangian-Sinemurian boundary. These new data together firmly suggest that the end-Triassic extinction and environmental events were indeed synchronous with volcanism in the Central Atlantic Magmatic Province and the biotic recovery in the Hettangian took place in a relatively short time, when the early Hettangian did not exceed 1 Ma in duration.

[1] Schaltegger *et al.* (2008) *EPSL* **267**, 266-275.