Dissolution morphology as an indicator of respiration mechanism in *S. oneidensis*

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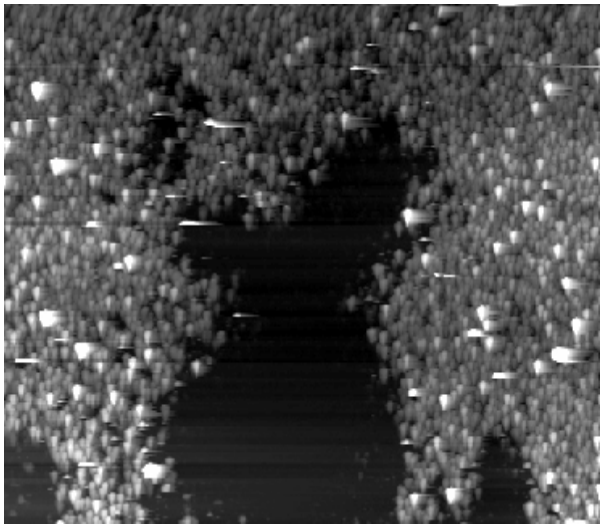
The mechanisms and kinetics of dissimilatory iron respiration by bacteria are important to a variety of globally significant environmental processes. As a tool to examine iron respiration, the dissolution of iron (oxy)(hydr)oxide particulate coated glass slides under a variety of conditions was observed with atomic force microscopy (AFM). It was found that the dissolution morphology of the particulates in the presence of wild-type *S. oneidensis* MR-1 is heterogeneous (Figure 1), whereas an abiological chemical reductant, 9,10-anthrahydroquinone-2,6-disulfonate (AH_2DS, oxidized form of AQDS), dissolves the coatings homogeneously. The behaviour of a gspD deletion mutant (deficient in solid-iron mineral respiration) respiring via an exogenous electron shuttle, AQDS, was also examined. The resulting dissolution morphology was homogeneous, similar to the abiotic experiments using AH_2DS. These results suggest that the kinetics of respiration of wild-type *S. oneidensis* MR-1 may be in part controlled by transport, whereas, the action of chemical reductants are primarily limited by surface processes. It is likely that wild-type organisms respire on iron (oxy)(hydr)oxides using a different reduction pathway(s) or kinetic regime(s) from AH_2DS and may explain the difficulty in comparing the kinetics of bacterial respiration to a chemical reductant.

Figure 1: Heterogeneous dissolution of iron oxyhydroxide particulates exposed to wild type *S. oneidensis* MR-1 for one day. Image size is 85 μm and Z-scale is 436.32 nm.



Zircon U-Pb age and Hf isotope evidence for growth and reworking of the Yangtze continental nucleus

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To understand the connection between continental cratonization and global tectonothermal event is essential for recognizing the formation and evolution of continental crust. For this purpose, a combined study of zircon U-Pb and Hf-O isotopes was conducted on migmatite, gneiss and metpelite from the Kongling complex (the only Archean microcontinent outcropped in South China) and the Liantuo sandstone in Yichang. The results show great significance for growth and reworking of Yangtze continental nucleus. A detrital zircon as old as 3.8 Ga was revealed by SHRIMP U-Pb dating for the Liantuo sandstone of middle Neoproterozoic age, implying the existence of crustal materials with this age in the Yangtze Block. Its Hf isotopes suggest growth of juvenile crust at 4.0 Ga. Zircon U-Pb ages for the migmatite and gneiss from the Kongling complex suggest two episodes of magmatism at 3.2-3.3 Ga and 2.9-3.0 Ga, probably marking formation of Yangtze continental nucleus at Mesoarchean. Their Hf isotopes suggest extraction of mafic protolith from the depleted mantle no later than 3.5 Ga ago.

U-Pb ages of 1.97±0.03 Ga were obtained with low Th/U ratios of 0.01 to 0.14 for metasediments and amphibolite from the Kongling complex, indicating that the ages are a record of Paleoproterozoic metamorphic event. $\varepsilon_{Hf}(t)$ values of about –6.5 and model Hf ages of about 3.0 Ga were acquired for zircons from the metapelites, suggesting an Archean source. Thus a response to the Paleoproterozoic global tectonothermal event in South China is reworking of Archean continental nucleus. A survey of Paleoproterozoic ages throughout the Yangtze Block suggests that metamorphic event and subsequent magmatic activity occurred in the north, but only magmatic activity in the south. Both metamorphic and magmatic activities are associated with formation of a unified basement responsible for cratonization of the Yangtze Block. This provides a geodynamic connection between the formation of this craton and the global tectonomagmatism in the Paleoproterozoic, marking continental accretion by arc-continent collision orogeny during assembly of the supercontinent Columbia.

A number of Neoproterozoic U-Pb ages were also dated in detrital and metamorphic zircons, consistent with those widely occurring in the periphery of the Yangtze Block. This period of tectonothermal events is associated with contemporaneous rift magmatism in response to the Rodinia breakup. It results in not only remelting of Archean and Paleoproterozic arc-derived crust but also prompt reworking of Neoproterozoic juvenile crust. Therefore, the growth of continental crust in the Yangtze Block started since the early Archean, but a stable craton through reworking did not occur until the Paleoproterozoic.