Oxygen Before Cyanobacteria implied from Magnetotactic Bacteria

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Magnetotactic bacteria (MTB) position themselves magnetically at oxic/anoxic and sulfate/sulfide transitions in redox stratified sediments. As opposed to the earlier polyphyletic idea[1], recent functional gene studies of magnetosome formation support a common origin of MTB[2-4], but their evolutionary relationship with other bacterial groups remains obscure. We analyzed over 700 MTB 16s rRNA sequences to elucidate the origin and evolution of MTB in relation to other Bacterial groups as shown below.

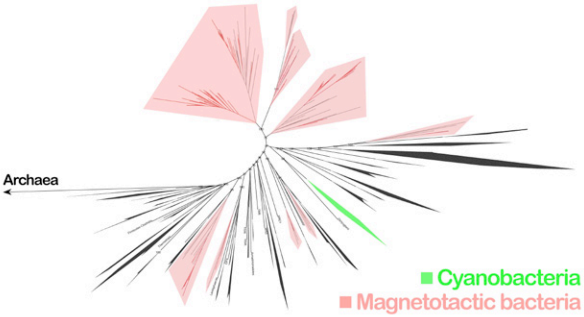

Figure 1. A Bayesian tree showing the molecular phylogeny of Bacteria, with special emphasis on magnetotactic bacteria.

Our phylogenetic analysis suggests a ubiquitous presence of MTB throughout all but the oldest branches of the bacterial tree. Four phyla with MTB appear before the cyanobacterial divergence, indicating a much earlier origin for this group than hypothesized. Horizontal gene transfer is an unlikely explaination based on the genetics and biochemistry of magnetsome formation. This result suggests the presence of pre-Cyano redox stratified environments in the Archaean, such as the peroxide-rich glacial runoff settings where oxygen mediating enzymes may have evolved[5]. Together with peroxidase and reactive oxygen species (ROS) scavenging properties of magnetosomes[6], MTB might have contributed to the adaptation to oxygen by mediating ROS toxicity in ancient microxic environments.

[1] Delong *et al*. (1993) *Science* **259**, 803–806. [2] Abreu *et al*. (2011) *ISME J* **5**, 1634–1640. [3] Jogler *et al*. (2011) *PNAS USA* **108**, 1134–1139. [4] Lefèvre *et al*. (2013) *EM* doi:10.1111/1462-2920.12097. [5] Liang *et al*. (2012) *PNAS USA* **103**, 18896. [6] Guo *et al*. (2012) *EM* **14**, 1722–1729.

Eco-geochemistry and Kashin-Beck Disease-A case study in Aba, Sichuan

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Kashin-Beck disease (KBD) is a chronic, endemic osteochondropathy (disease of the bone), but it is not clear what is the cause. There are still new cases of KBD in part of the Tibet, Qinghai and Sichuan province in recent years[1], severely damage the wellbeing of the local population.

The distribution characteristics of selenium(Se), calcium(Ca), molybdenum(Mo), iron(Fe), zinc(Zn) and strontium(Sr) in environmental media, plants, animals and human blood, urine and hair in Aba, Sichuan were studied with the theory and method of eco-geochemistry. Elements related to KBD were disclosed. The geochemical processes of migration and transformation of Se and other elements, the healthy risk and the KBD eco-geochemical model of the population in studied area were established. The practical prevention and control measures for KBD in the area were suggested.

It is proved that the Se, Ca, Zn, Fe, Mn, Mo, Sr are all deficient in these environmental media in the area, the Se in soil is 0.12mg/kg on average, far lower than that of in Chengdu Economical Zone□0.28mg/kg□and the average of whole country (0.26mg/kg).

New KBD cases are all from inhabitence on the slopes in the valley, where in contrast to the control area, Ca, Se and some other elements in surface soil were severely leached and most soil pH was nearly acidic to neutral.

The results of the present study could be applied to the improvement of the environment in KBD area and reduce the KBD incidence, is an important progress on eco-geochemistry and KBD research.

[1] Tan et al. (2002) The Science of the Total Environment **28**, 227-235.

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