U-Pb dating of zircons from eucrites: A preliminary report

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We report preliminary results of U-Pb ages of zircons from four basaltic eucrites (Bereba, Igdi, Juvina and Millbilliliie) in order to elucidate the timing of crystallization of basaltic volcanism on eucrite parent body (EPB). Eucritic zircons in polished mounts are associated with ilmenite in most cases and have subhedral shapes wih usual size of less than 10μm. Eleven zircons were analyzed for U-Th-Pb isotopes with an ion microprobe (SHRIMP). Owing to the small size of the zircons, most of them were entirely consumed during the U-Pb analyses and thus multiple spot analyses of single zircon could not be peformed.

Uranium concentrations of zircons are around 40–100 ppm, fairly typical of eucritic zircons [1]. All U-Pb systems of zircons are almost concordant but some show reverse discordance. The chord of three zircon grains of Igdi intercepts the concordia at 4553 ± 43 Ma. An average ^{207}Pb-^{206}Pb age of the igdi zircons is 4554 ± 20 Ma, which is indistinguishable from the previously reported crystallization age (4554 ± 7 Ma) of eucritic zircons [1]. The chord of three zircon grains of Bereba intercepts the concordia at 4538 ± 26 Ma. Excluding one zircon grain with highly reverse discordance (~15%), an average of ^{207}Pb-^{206}Pb age of two Bereba zircons is 4530 ± 23 Ma, which is consistent with 4534 ± 16 Ma of the same sample [2] . The chord of three zircon grains of Millbilliliie intercepts the concordia at 4527 ± 260 Ma, but excluding one higly discordant zircon (~13%), the chord of two zircon grains intercepts the concordia at 4540 ± 17 Ma. An average of ^{207}Pb-^{206}Pb age of two Millbilliliie zircons is 4543 ± 15 Ma. Two zircon grains of Juvina do not define a chord and give an average of ^{207}Pb-^{206}Pb age of 4527 ± 24 Ma. Igdi zircons likely date pristine crystallization event of basaltic volcanism on EPB. However, others may date either prolonged period of basaltic volcanism or later thermal disturbance due to impacting on EPB.

[1] Misawa *et al.* (2005) *GCA* **69**, 5847-5861. [2] Bukovanska & Ireland (1993) *Meteoritics* **28**, 333.

A formation of uranium phosphate, ningyoite, by *Shewanella p.* CN32

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A variety of anaerobic bacteria can catalyze the reduction of soluble species of U(VI) to insoluble U(IV) forms. The U(VI) is readily reduced by dissimilatory metal-reducing bacteria (DMRB) under anoxic conditions, resulting in the precipitation of uranium solids. The rapid rate of U(VI) reduction by DMRB [1] and the relatively low solubility of U(IV) makes biomineralization an attractive option for removing soluble U from groundwaters.

The ability of *S. putrefaciens* strain CN32 to reduce U(VI) was evaluated in the presence or absence of inorganic elements such as P, Fe, and Mn. The concentration of injected U was 5×10^{-5} M.

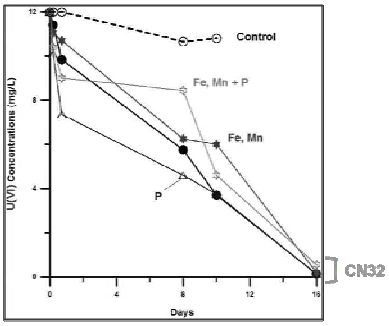

Figure 1: Changes of U(VI) concentrations by the influence of *S. putrefaciens* CN32 bacterium.

The U(VI) reduction was promoted by the CN32 microbe. The degree of U removal was much higher in an initial stage with P component in the solution. Besides of a newly-formed uraninite, another phosphate precipitate was also formed as ningyoite [$CaU(PO_4)_2 \cdot H_2O$], which is an insoluble uranium phosphate mineral.

The *Shewanella p.* CN32 can not only reduce U(VI) to U(IV), but also remove it as various forms of nano-particles from the U(VI)-containing solution. This phenomenon suggests that the anaerobic metal-reducing bacteria living in a deep groundwater can sufficiently reduce oxidized radionuclides and form several reduced nano-minerals suppressing their movement in subsurface environments.

[1] Truex *et al.* (1997) *Biotech. Bioeng.* **555**, 490-496.