Penglai zircon: A potential new reference for microbeam analysis of U-Pb age and O-Hf isotopes

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Zircon is a common U-rich accessary mineral occurring in many rocks. Modern mircrobeam techniques such as SIMS and LA-ICPMS make zircon the most important material used for U-Pb dating and O-Hf isotopic study. The availability of well-characterized natural zircon standards are fundamental to achieve accurate results. It would be ideal if a zircon standard is homogeneous in both U-Pb age and O-Hf isotopic compositions as well as available in quantity to the scientific community. Although there are several natural zircon standards (e.g. SL 13, 91500 and Temora) that have widely been used for microbeam analyses of U-Pb age and to lesser extent Hf-O isotopes, they are limited in quantities for increasing requirements of laser ablation analysis.

The Penglai zircon is megacrysts (several to over ten mm long) occurred in the early Pliocene basalts from northern Hainan Island (China), with nearly unlimited quantity. The zircon is generally translucent and maroon in color. Qiu *et al.* [1] analyzed Hf isotopic data of this zircon by LA-MC-ICPMS, yielding a fairly homogeneous $^{176}Hf/^{177}Hf$ ratio of 0.28292 ± 1. Our measurements by solution MC-ICPMS give a consistent result. The Penglai zircon was dated by using the LA-ICPMS and SIMS at 4.22 ± 0.17 Ma and 4.10 ± 0.11 Ma, respectively, which are identical within errors to a K-Ar age of 4.05 Ma for the host basalt [2]. Precise age awaits further ID-TIMS analysis. Oxygen isotope data were obtained by fluorination-IRMS and SIMS techniques. Seventy-eight $\delta^{18}O$ measurements by SIMS form a Gaussian distribution with a weighted mean of $5.27 \pm 0.05‰$ (relative to the value for 91500 standard zircon of $\delta^{18}O = 9.9‰$). This is consistent with an average $\delta^{18}O$ value of $5.30 \pm 0.10‰$ of three parallel measurements by IRMS. Further characterization of U-Pb age and O-Hf isotopic compositions of the Penglai zircon is in progress.

[1] Qiu *et al.* (2005) *Chi. Sci. Bull.* **50**, 2602-2611. [2] Zhu & Wang (1989) *Geochimica* **18**, 193-201.

Biogeochemistry of sulfur cycling in the Cariaco Basin

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The biogeochemistry of sulfur was investigated in the Cariaco Basin during Nov, 2007 as part of the on-going CARIACO (Carbon Retention In A Colored Ocean) time series project. Concentration of dissolved and particulate sulfur species, including the sulfur intermediates (sulfite, thiosulfate and elemental sulfur), particulate acid volatile sulfur, greigite, pyrite and total sulfur, were analyzed at high resolution near the oxic-anoxic interface. The concentrations of sulfite, thiosulfate and particulate elemental sulfur were mostly submicromolar. Acid votatile sulfur was low thoughout the water column, with the highest concentration, 0.2 nmol/L, found in the deepest water. Greigite and pyrite showed distinct maxima near the interface, with two maganitudes lower than sulfur intermediates. This corroborates our previous study of sulfur species and chemoautotrophic production, which suggests the reaction of sulfide with FeOOH as an important pathway for sulfide oxidation and sulfur intermediate formation near the interface [1]. Pyrite and elemental sulfur distribution pattern, together with the pH in the water, suggests pyrite formation via the reaction of FeS with poly-sulfides or particulate elemental sulfur near the interface.
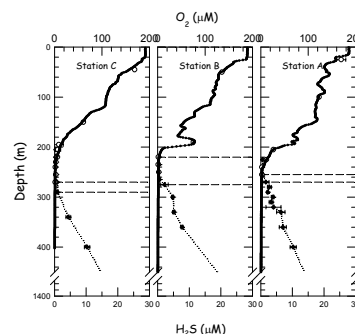
We also measured the $\delta^{34}S$ value of total dissolved sulfide ($\delta^{34}S_{H2S}$) and sulfate ($\delta^{34}S_{SO4}$), and the $\delta^{18}O$ value of sulfate ($\delta^{18}O_{SO4}$) from water samples. In close agreement with the result of Fry *et al.* [2], $\delta^{34}S_{H2S}$, $\delta^{34}S_{SO4}$ and the $\delta^{18}O_{SO4}$ did not change much in the deep anoxic water, with the $\delta^{34}S_{H2S}$ depleted in ^{34}S relative to $\delta^{34}S_{SO4}$ roughly 50‰. However, sulfur isotope data near the interface suggest that bacterial sulfur disproportionation was important.

[1] Li *et al.* (submitted) *Marine Chemistry*. [2] Fry *et al.* (1991) *Deep Sea Research* **38**, 1003-1019.