U-Th-Pb analyses by eximer laser ablation/ICP-MS on MG Brazilian xenotime

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Measurements

Several fragments of MG xenotime were mounted in epoxy disk (2.54 cm). Temora, FC and GJ standards were used as reference. The analytical conditions were: RF = 1200 Watts, Cooling gas = 15 L/min, Aux gas = 0.70 L/min, Sample gas flow = 0.75 L/min. Detector configuration: $^{202}Hg = IC_3$, $^{204}Hg + ^{204}Pb = IC_4$, $^{206}Pb = L_4$, $^{207}Pb = IC_6$, $^{208}Pb = L_3$, $^{232}Th = H_2$ and $^{238}U = H_4$, where IC = MIC, L (low) and H (high) are Multi Faraday Cups. The intensity to ^{80}Ar for stable condition was around 10V (aux gas =0.77 L/min and He gas = 0.65 L/min). The Laser analytical conditions to get the best ablation rate were: wavelength = 193 nm, Energy = 6mJ, Repetition rate = 10Hz, He gas flow = 0.65 L/min, spot size = 38 mm.

Results

The MG crystal shows Th concentration ranging from 300 to 2000 ppm with low common Pb ($^{204}Pb/^{206}Pb$ ratio <0.0001). The Th/U ratio ranges from 0.9 to 4.5. The GJ show low ^{232}Th intensity (~2 mV) but high ^{238}U (150 mV) intensity while MG shows high ^{232}Th (150mV) and normal ^{238}U intensity (90mV). Also the $^{232}Th/^{238}U$ ratios on GJ zircon standard range from 0.012 to 0.022, while in the MG ratio are much higher ranging from 0.7 to 4.7. The ^{232}Th intensity on GJ zircon standard range from 0.7 to 3 mV, while MG presents 130 mV (gray portions) to 900 mV (brown portions). Electron microprobe analyses, indicate high contents of Dy_2O_3 (3 – 6%), Er_2O_3 (3-4%), Yb_2O_3 (2-3%) and Lu_2O_3 (0.3 – 0.8%) for MG. The $^{206}Pb/^{238}U$ weighted average age of 445.8 +-4.5 Ma using GJ1 as standard, is lower than the TIMS age of 492Ma (1). This difference must be investigate but here it is suggested to be related to matrix effect.

Conclusions

The MG xenotime present a high U content, permitting precision measurements which is very helpful for the beam focusing during the LA-ICP-MS pre-adjustment set up. Therefore its high REE and Th concentrations, require matrix corrections of several percent for data from most zircon samples.

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Effects of non-supercritical CO_2 on leaching of potential microbial substrates from macromolecular organic matter

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The storage of CO_2 in underground reservoirs is discussed controversly in the scientific literature and the public. The worldwide search for suitable storage formations also considers coal bearing strata. In addition, injection of CO_2 into coal formations is already applied for enhanced gas recovery of coal bed methane. Nevertheless, processes resulting from increased CO_2 concentration especially in organic matter rich formations are rareley investigated.

Depending on reservoir pressure and temperature, the injected CO_2 will dissolve in the porewater causing a decrease in pH [1] and resulting in acidic formation waters.

Recent investigations outlined the importance of potential substrates (e.g. low molecular weight organic acids) stored in organic-rich litologies such as coals [2]. Huge amounts of these substrates are chemically bound to the macromolecular matrix and may be liberated by hydrolysis within the acidic porewater. Therfore, injection of CO_2 into coal formations may result in an enhanced nutrient supply for microbial metabolism.

To study the effects of high dissolved CO_2 concentrations on macromolecular organic matter, we developed an inexpensive, high-pressure high-temperature incubation system. It allows not just controlling hydrostatic pressure and temperature but also the concentration of dissolved gases. Furthermore the system can be used for both static and flow through experiments and also allows subsampling during the experiment without depressurization.

We will present results from leaching experiments of low molecular weight organic acids such as formate and acetate with CO_2 saturated water at variing temperature and pressure conditions on coal samples of different thermal maturity.

[1] Meyassami *et al*. (1992) *Biotechnol. Progess* **8**, 149–154.
[2] Glombitza *et al*. (2009) *Org. Geochem*. **40**(2), 175–185.