In search of new carbonate reference materials for high-precision U-Pb geochronology

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Context

Latest advances and analytical developments allow for accurate in-situ U-Pb dating of carbonate material (e.g. LA-ICPMS). Cross-laboratory reference materials (RMs) used for sample-bracketing are currently limited to WC1[1] with an age of 254.4 ± 6.5 (2σ), JT[2] with an age of 13.797 ± 0.031 (2σ), and ASH15[3] with an age of 2.965 ± 0.011 (2σ) Ma. The minimum uncertainty on any age determination depends on the age uncertainties of the RMs and is therefore between 2.5-0.22 %. Because of the limited availability of RMs, validation by secondary RMs is usually performed on in-house standards or is not performed at all. Reference materials with high Pb and low U, or both low U and Pb compositions are still needed to fully cover the compositional range of carbonate material. This project will explore some new candidate samples for reference materials to be dated by high-precision dating technique (ID-TIMS). The results of this study will provide new reference materials to be used as primary and secondary RMs by these fast-growing scientific community around the world.

Objectives and Methods

Methods: TIMS, LA-MC-ICPMS, Cathodoluminescence
Objectives: dating carbonate reference materials with high-precision U-Pb ID-TIMS dating.

Literature

[1] Roberts, Nick MW, E. Troy Rasbury, Randall R. Parrish, Christopher J. Smith, Matthew SA Horstwood, and Daniel J. Condon. "A calcite reference material for LA-ICP-MS U-Pb geochronology." Geochemistry, Geophysics, Geosystems 18, no. 7 (2017): 2807-2814.

[2] Guillong, M., Wotzlaw, J. F., Looser, N., & Laurent, O. (2020). Evaluating the reliability of U–Pb laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) carbonate geochronology: matrix issues and a potential calcite validation reference material. *Geochronology*, *2*(1), 155-167.

[3] Nuriel, Perach, Jörn-Frederik Wotzlaw, Maria Ovtcharova, Anton Vaks, Ciprian Stremtan, Martin Šala, Nick MW Roberts, and Andrew RC Kylander-Clark. "The use of ASH-15 flowstone as a matrix-matched reference material for laser-ablation U–Pb geochronology of calcite." Geochronology 3, no. 1 (2021): 35-47.

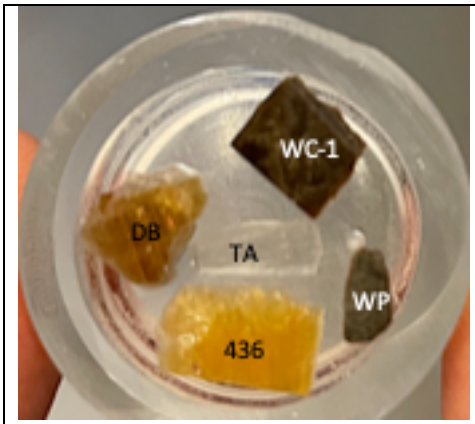

Figure 1. Example for carbonate RMs being used for LA-ICPMS analyses. **WC-1** – Walnut Canyon, 254 ± 6.5, U 3.7 ppm (Roberts et al 2017), **DB** - Duff Brown Tank: 64 ±0.67 Ma (Hill et al., 2016), low 207/206 ratio within upper intercept, and high U, good spread of U/Pb. **WPT** - White Pine Travertine: 13 Ma, close to concordia, ~ 1 ppm; **UCSB 436** - 11.5 Ma and 1 ppm U, from UCSB collection. **TA** - Triangle: ~21 Ma with variable U concentrations.

Choice of orientation : (supprimer les orientations qui ne conviendraient pas)

2) Geochemistry, Isotopes Geochemistry 3