

A new reference material candidate RA138 for U-Pb carbonate dating by LA-ICP-MS

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The growing community interested in LA-ICP-MS U-Pb dating of carbonates is in urgent need of additional and better reference materials (RM). Only a very limited number of useful RM for U-Pb carbonate dating available. The most used and so far best as primary RM to correct the $^{238}\text{U}/^{206}\text{Pb}$ ratio is WC1[1]. However, WC1 displays non-negligible heterogeneity in age when dated by high precision ID-TIMS (MSWD=1069). Other available RM like JT[2], ASH15-D[3], are more suitable for dating young samples or using more sensitive instruments due to their lower radiogenic Pb content (lower precision) and larger error propagation.

We present detailed investigations by ID-TIMS and LA-ICP-MS of reference material candidate RA138. This carbonate sediment from Spain contains botryoidal cements showing an exceptional homogeneity by ID-TIMS (MSWD=2-6), a relatively high uranium concentration (1-10 ppm) and large variation of $^{238}\text{U}/^{206}\text{Pb}$ ratios (1-20). ID-TIMS data show a much lower dispersion of analyses around the isochron ($3xx.2 \pm 0.2$, MSWD 5.8, n=9, Fig. 2) compared to WC1 (Age 254.4 ± 6.4 , MSWD 1069 n=10) [1]. Due to the lower uncertainty associated with the ID-TIMS age of the RM, the propagated uncertainties on unknown samples will become significantly smaller. Improved precision opens this method to a broader field of applications and improved investigation on matrix effects, e.g. between calcite, dolomite and aragonite.

We will present age data from 2 ID-TIMS Laboratories and several LA-ICP-MS laboratories using a whole variety of LA systems, ICP-MS and dating approaches. In this way we will show the repeatability and accuracy relative to the established WC1. Additionally, trace element distribution and concentrations, CL images and major elements compositions are presented, and we discuss the homogeneity and usability as primary RM for U-Pb carbonate dating in comparison with the established RM.

Figure 1: LA-ICP-MS (A) and ID-TIMS (B) Isochron in the Tera-Wasserburg Concordia diagram of RM candidate RA138.

1. Roberts, N.M.W., et al., *Geochemistry Geophysics Geosystems*, 2017, **18**(7): 2807-2814.
2. Guillong, M., et al., *Geochronology*, 2020, **2**(1): 155-167.

