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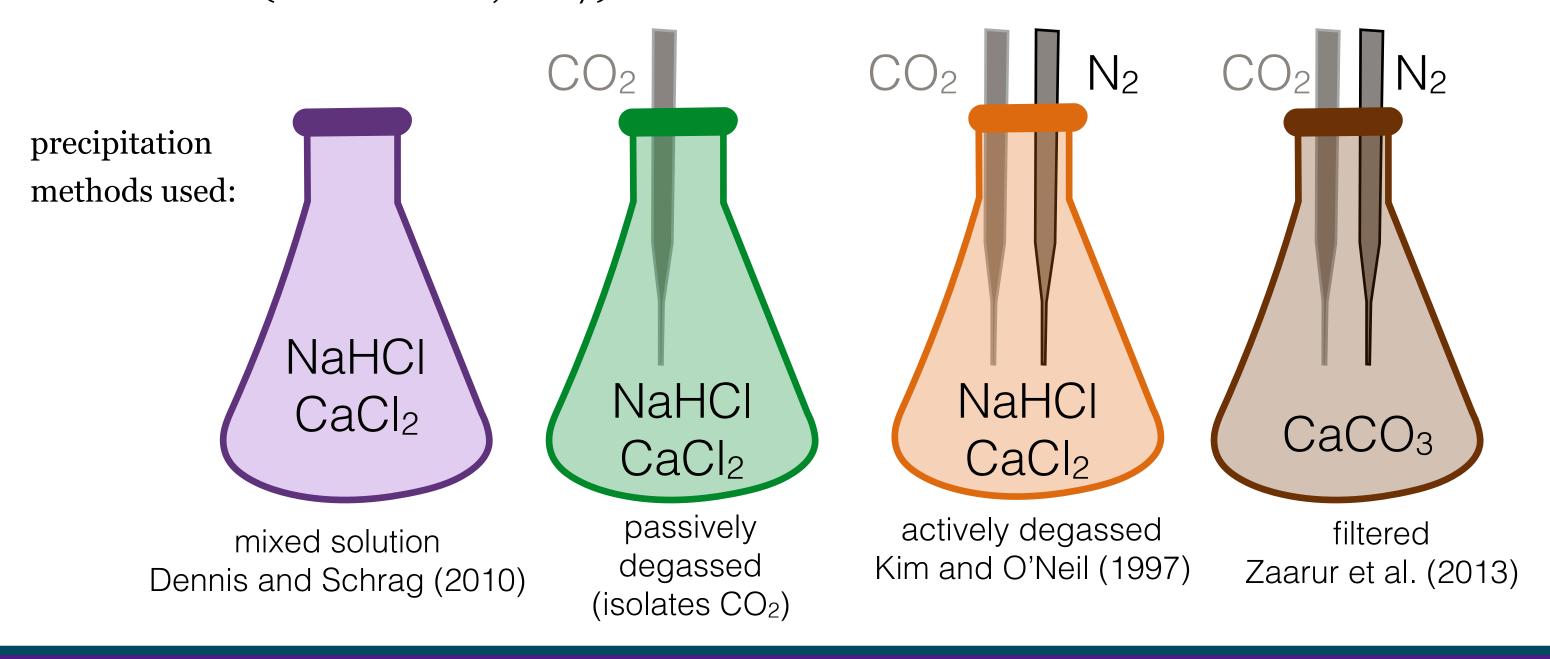
Choice of ¹⁷O Abundance Correction Affects Δ_{47} and its Paleothermometer Calibration

. Reconstructing temperature from carbonates: from Δ_{47} thermometer calibrations to ¹⁷O corrections

- The clumped isotope composition of CO2 derived from carbonate (Δ_{47}) varies with temperature, making it a valuable geothermometer with broad geoscience applications. However, it's plagued by inter-laboratory discrepancies of carbonate reference materials and Δ_{47} -temperature calibrations.
- Calibration discrepancies could be caused by different carbonate precipitation methods used by previous workers. We address those discrepancies with Δ_{47} data from 58 carbonate samples precipitated at 4-85 °C using a variety of methods and measured in a constant analytical setting.
- This carbonate data (and related equilibrated gases) uncovered a systematic error in the traditional way that Δ_{47} is calculated. The data show a dependency of Δ_{47} on δ^{13} C, which should not exist according to clumped isotope theory.
- The erroneous dependency of Δ_{47} on δ^{13} C is removed when updated ¹⁷O correction parameters are used. This parameter may affect other inter-laboratory discrepancies reduce the uncertainty in $\Delta 47$ temperature reconstructions. —> Schauer et al., 2016 RCM
- Using the updated data processing method, we show that Δ_{47} calibrations do not depend on carbonate precipitation methods tested. This work points toward a path to unify clumped isotope calibrations. —> Kelson et al., 2017 GCA

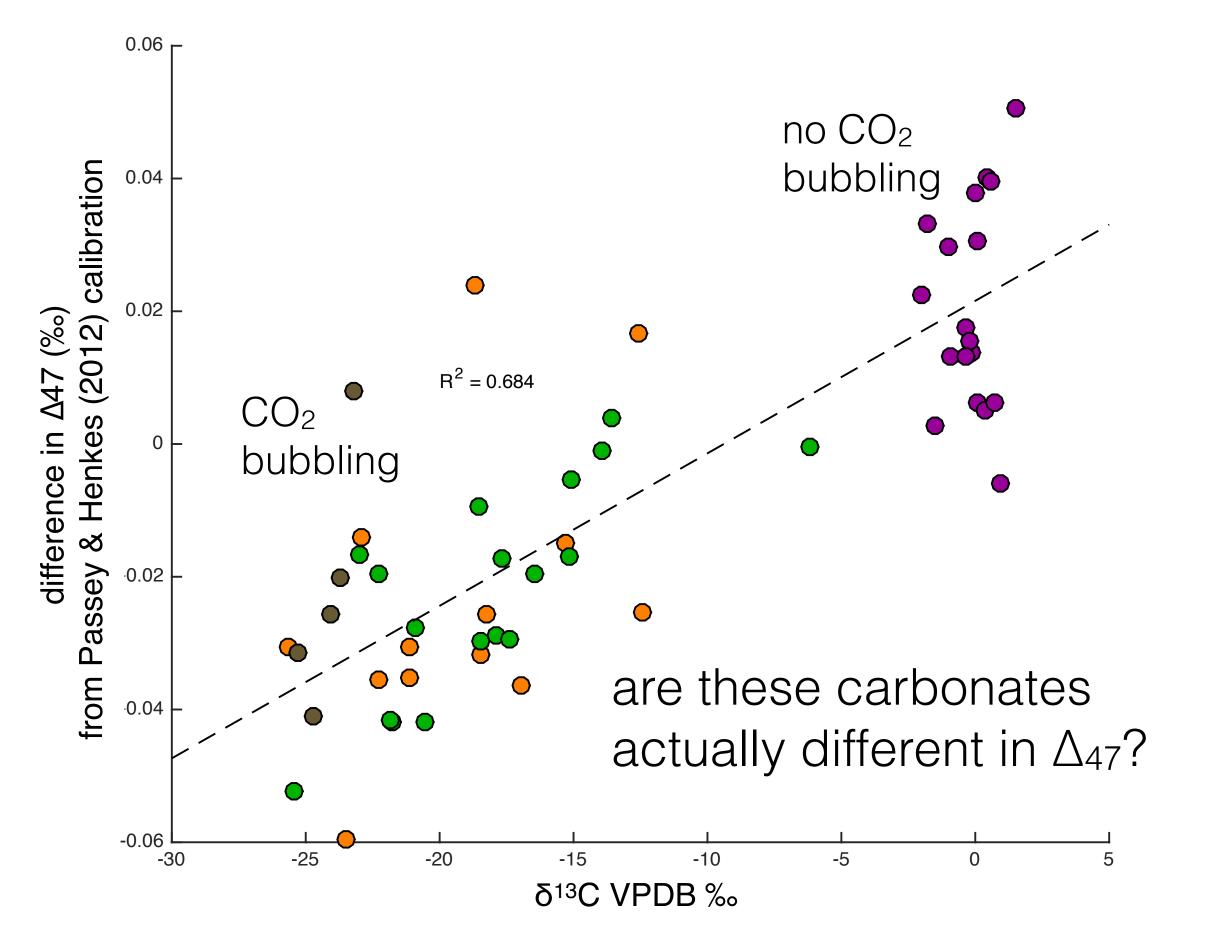
2. Initial goal: address interlaboratory discrepancies in Δ_{47} - T calibrations

- Previous calibrations likely diverge due to differences in the methods used to 1) precipitate carbonate samples or 2) analyze the carbonates.
- We isolate variables by measuring the Δ_{47} of carbonates precipitated via 4 main methods at 4-85 °C, and analyzing them under a constant analytical setting (90 °C or 25 °C acid digestion). Our precipitation methods replicate those used to grow carbonates for previous $\Delta 47$ -T calibrations (Kelson et al., 2017).



3. Data brings to light a Δ_{47} dependence on ^{13}C

• Samples that are depleted in ¹³C are also depleted in Δ_{47} . We suspect this is an analytical artifact.



Difference between Δ_{47} of UW synthetic carbonate samples and the Δ_{47} values predicted by the calibration of Passey and Henkes (2012) (which is Schauble et al. (2006) theoretical calibration adjusted to agree with high temperature samples), plotted against δ^{13} C of the carbonates. CO₂ gas bubbled into these experiments has δ^{13} C of -36 ‰ VPDB, which imparts a lower δ^{13} C value to the resulting samples. We observe a correlation between δ^{13} C and Δ_{47} . Clumped isotope theory (e.g., Schauble et al., 2006) says that Δ_{47} should not depend on bulk isotopic composition of the carbonate mineral.

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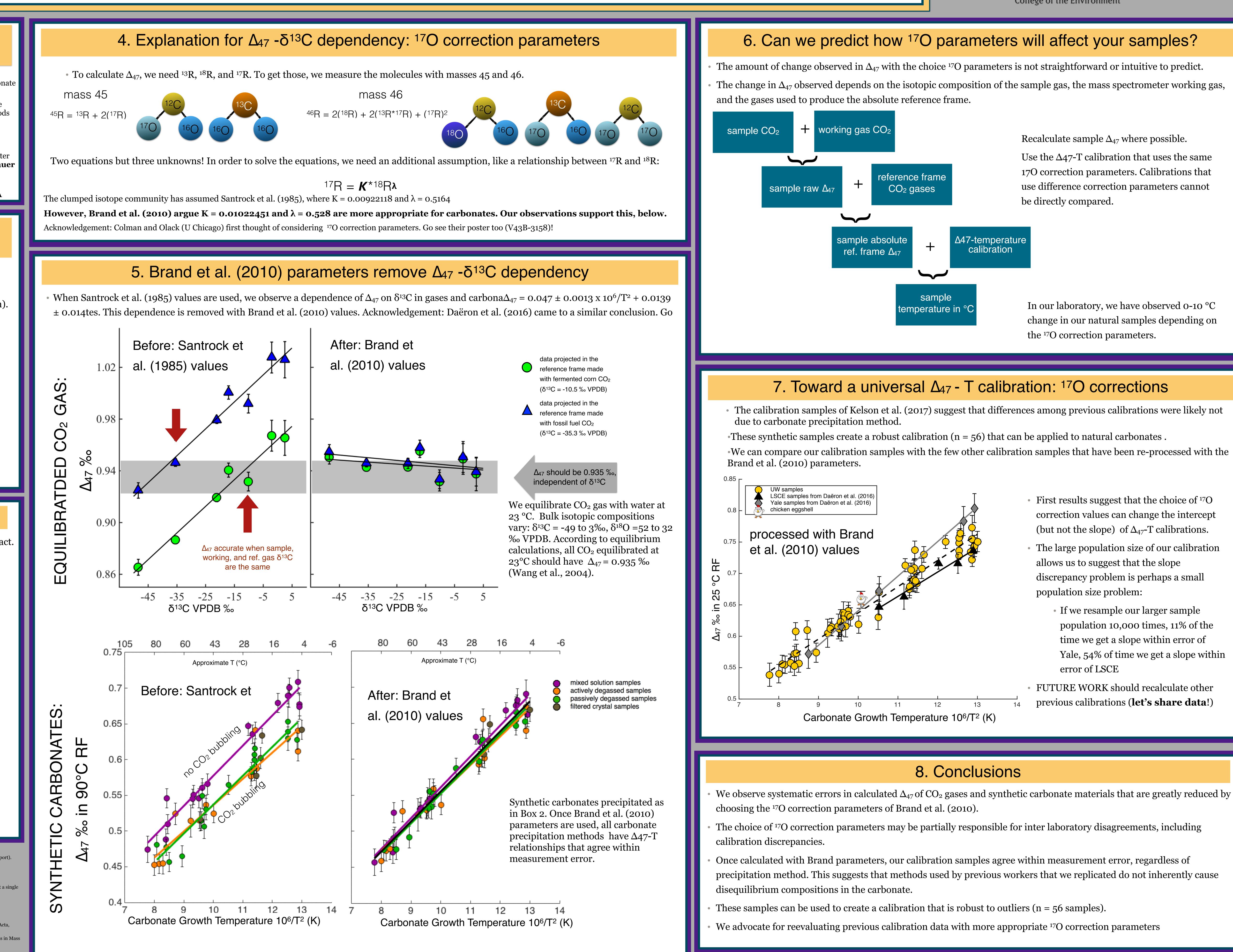
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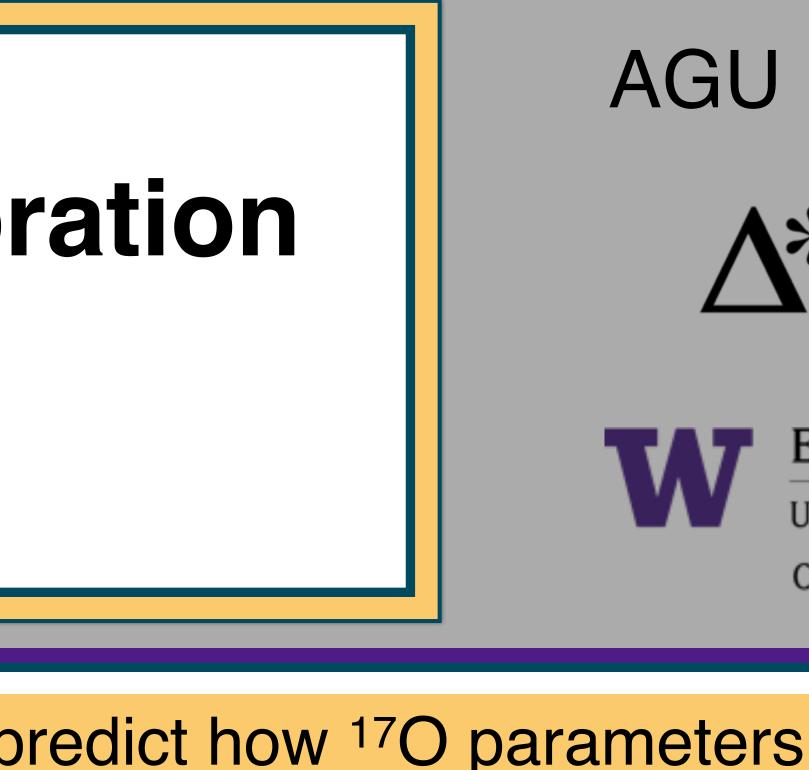
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