# Optimizing Gas Stable Isotope Measurements in Geochemistry

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**Introduction:**

The importance of gas stable isotopic measurements in the wide field of geochemistry is steadily increasing. However, valid sampling and shelf life strategies have yet to be determined using formal scientific methodology.

**Results & Discussion:**

Custom gas mixtures were prepared to evaluate subsampling and pressure reduction strategies as well as to validate the shelf life of the hydrocarbon containing mixtures through a dedicated analytical program.

Several methods were evaluated. Direct injection from a 34L cylinder would be ideal due to the low sample volume; however, two other methods yielded better overall results: the 2-stage regulator and the flow-through regulator. The septum flow-through regulator consumed the greatest amount of gas but yielded the lowest standard deviation for carbon isotope composition ($\delta^{13}C$) of C1 (0.2‰), C2 (0.1‰) and C3 (0.1‰), as well as hydrogen isotope composition ($\delta H$) of C1 (3‰).

Pressure reduction from gas mixtures of greater than 800psi were evaluated using both a low dead volume 2-stage piston regulator as well as a traditional 2-stage regulator. Although both regulators showed less than 0.1‰ variation for C1 and O (using $CO_2$ as the exemplar), the low dead volume piston regulator achieved steady state faster, thus using less gas.

One-year shelf life was validated for 2 mixtures: (1) 3% C3 in balance nitrogen and (2) 87% C1, 7% C2, 3% C3, 1.5% $N_2$, 1.5% $CO_2$. $\delta^{13}C$ for hydrocarbons and $CO_2$ varied less than 0.2‰, $\delta H$ for hydrocarbons were within 1‰ and $\delta^{15}N$ was within 1.2‰.