



Carbon Isotopic composition of rocks measured by optical spectroscopy

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We have successfully analyzed powdered rock samples containing kerogen or graphite by flash combustion followed by isotopic CO₂ cavity ring-down spectrometer using the CM-CRDS system provided by Picarro Inc. We found that rocks containing more than 0.5% TOC provide effective combustion and sufficient yield of CO₂ to obtain high analytical precision of the Carbon C¹³/C¹² ratio.

We find that 1 mg of carbon corresponds to a CO₂ concentration of 3000 ppm in the laser spectrometer. The instrument is stated to have a typical $\delta^{13}\text{C}$ precision of 0.2‰ when CO₂ concentrations are within the range 2000 ppm to 4000 ppm (0.6 mg to 1.3 mg Carbon). We have made measurements of USGS-24 graphite standard which show that the best precision may be achieved with concentrations ranging from 3000 ppm to 7500 ppm (1 mg to 2.5 mg Carbon) providing a precision of 0.05‰ in $\delta^{13}\text{C}$.

We have observed large memory effects in the combustion unit in some experiments. We have worked to optimize Oxygen flow and sample packaging to alleviate this problem. This study show that total sample weight of less than 75 mg and a 10 mL oxygen pulse for flash combustion effectively eliminate memory effects in the combustion unit.

We have also initiated measurements of several kinds of geological samples. We have made preliminary experiments on $\delta^{13}\text{C}$ measurements of carbonates. Powdered carbonates were mixed with quartz powder and find a precision of these measurements better than 0.1‰. Work on cross calibration with mass spectrometric measurements, of samples straddling the SPICE isotopic excursion in a Cambrian Alum shale stratigraphic section, will also be presented.