

Developing micro-Raman mass spectrometry for measuring carbon isotopic composition of carbon dioxide

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We investigated the applicability of micro-Raman spectroscopy for determining carbon isotopic compositions ($^{13}\text{C}/^{12}\text{C}$) of minute CO_2 fluid inclusions in minerals. This method is nondestructive and has sufficiently high spatial resolution (1 micron) to measure each fluid inclusion independently. Raman spectra of CO_2 fluid have $^{12}\text{CO}_2$ -origin peaks at about 1285 cm^{-1} and 1389 cm^{-1} ($n^{[12]_-}$ and $n^{[12]_+}$) and a $^{13}\text{CO}_2$ -origin peak at about 1370 cm^{-1} ($n^{[13]_+}$). The relationship between carbon isotopic compositions and peak intensity ratios of $n^{[12]_+}$ and $n^{[13]_+}$ was calibrated. Considering several factors affecting the peak intensity ratio, the error in obtained carbon isotopic composition was 2%. The reproducibility of intensity ratio at the same experimental environment was 0.5%. Within these error values, we can distinguish biogenic CO_2 from abiogenic CO_2 .

We will report on application of micro-Raman mass spectroscopy to several natural fluid inclusions.